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The distribution of the Bulletin in signatures has been discontinued.

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BULLETIN

OF THE

AMERICAN MUSEUM OF NATURAL HISTORY.

VOLUME XIV, 1901.

Article I.—ADDITIONAL OBSERVATIONS ON THE CREODONTA.

By W. D. MATTHEW.

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I. Classification. Arrangement of the Creodonta, chiefly on the basis of the specialized carnassial.

II. Family Viverravidæ. Characters of the skull and skeleton of *Viverravus* Marsh (= *Didymictis* Cope), as shown in two species, *V. protenus* and *V. leptomylus* Cope.

III. Family Arctocyonidæ. Fore and hind feet of *Clænodon*, with a discussion of its relations to the Ursidæ.

IV. Family Hyænodontidæ. Revision of the classification. Revision of the genus *Sinopa* (*Stypolophus*) with descriptions of two new forms.

V. Family Mesonychidæ. The oldest known mammal skull (*Triisodon heilprinianus*). Dentition and skeleton of *Pachyæna gigantea*. Pseudo-marsupial characters of the Mesonychidæ.

I.—CLASSIFICATION.

In classifying any group which includes a large proportion of primitive types we must use some combination of two methods. A division may be considered either as a group of forms resembling a given type within certain limits, or as including a particular line of development. Osborn has termed these two principles of classification the "horizontal" and "vertical"; it appears to the present writer that *group* and *race* would more truly express their intent. By the former method the unspecialized ancestral types of several families are placed in a separate family, from which the later families are derived. This is on the ground that the distinctions between the different lines of descent were not at first wide enough to be of family value, and that the different primitive types resembled each other more than they did any of the later specialized types. The other method of classification divides up these primitive types among the various specialized families to which they are ancestral or approximately ancestral. The group conception — the Latin *familia* = household — is, of course, the original use of the term; the race conception — the English *family* — has been introduced to meet the new conditions brought in by the doctrine of evolution and the development of palæontology.

It seems to the writer that either principle, used exclusively, results in obscuring, or at least imperfectly indicating, the real relationships the expression of which should be its chief purpose. The group method ignores parallelism, and fails to properly emphasize the lines of descent. The race method equally fails to emphasize the near relationship of the primitive root types, and in practice causes much confusion and apparent variance of opinion by the attempt to divide into different families species among which the distinctions have not yet become of generic value.

Among the fossil Mammalia these two methods are used in very varying proportion. In some groups, such as the Perissodactyls, the divisions have been drawn 'vertically,' all the ancestors of a family being placed in that family, so that the primitive Perissodactyls of the Lower Eocene, exhibiting no more difference in the sum of their characters than the different species of modern *Rhinoceros*, are divided among six different families, the typical forms of which are extremely different from any of these primitive forms; and the various species are moved about from one to another of these families with the utmost facility by every author who attacks the problem anew. In fact, constant specific distinctions are not always easy to find among them. In other groups, such as the Creodonta, all the ancestors of the modern types, together with those ancient types which have left no descendants, are placed in a separate suborder, distinguished by the absence of a specialized character common to all the modern families. Similarly among the Creodont families, the primitive types have been grouped separately from the specialized ones by almost all writers, the family distinctions being on points of specialization or non-specialization.

The present writer is in a position to appreciate very much the evil effects of unnecessary changes in nomenclature and is inclined to deprecate most strongly the perpetual changes caused by a too strict adherence to laws of priority which were not designed for palæontology, and do not entirely fit its requirements. With the progress of the science it becomes more and more evident that a very large proportion of the earlier species were founded on indeterminate material; and the vain attempt to find reasons for identifying these fragments with one or another of the species distinguishable by more perfect material has wasted a vast amount of time, and, however valuable from an antiquarian standpoint, adds not one iota to our knowledge of the fossil animals themselves and their place in nature. Scientific names are not different from other names — they are merely arbitrary terms representing each a certain conception; and it appears to the writer that custom should be the chief rule to govern their use.

With classifications the case is different. A classification is not arbitrary, but an expression of the natural relationship as nearly as our knowledge of the species and the limitations of the method used will permit. Conservatism in classification would mean cessation in the increase of our knowledge of a group; uniformity in it would be impossible, unless all observers attached the same relative importance to the same characters. A comparatively slight divergence of opinion on the last point may involve an entire upset in the classification scheme. A graphic method (such as is used on p. 21 in illustrating the relations of three of the Creodont families) would more accurately express the conception; but in such a method it is seldom possible to include all members of a group — the physical difficulties of space of two dimensions prevents the complete representing of polydimensional relationships.

In venturing, therefore, on very considerable changes in classification from that generally accepted, and embodied especially in so accurate and recent a text-book as Prof. Zittel's, I must disclaim any really radical changes in relations, except in a few cases. The recent study of far more complete Creodont material than has ever before been accessible has led American students to perceive the fundamental importance of certain lines of genetic cleavage somewhat less appreciated hitherto, and to make these the primary basis for division rather than differences which are now perceived to be in large part only contrasts between primitive and specialized types.

First in importance among these characters of divergent specialization is the position of the carnassial teeth. In the primitive types the shear between upper and lower molars is absent or rudimentary and about equally developed on all three molars. In some of the specialized types it is chiefly between p^4 and m_1, as in all modern Carnivora. In others it is chiefly between m^1 and m_2, or between m^2 and m_3. A large number of the primitive genera of the Creodonta show, in some of their species at least, a more or less evident tendency towards one of these three specializations.

A primary division on these lines, worked out by Dr. Wortman and the writer, and published by Wortman a year ago ('99, p. 139), had been previously independently elaborated though not published by Prof. Osborn for use in his University lectures, in either case chiefly the result of study of the large series of Creodonta in the American Museum collections.

Another line of cleavage as yet imperfectly known, but which may prove to be of importance equal to or greater than the above, lies in the character of the claw-phalanges. In one group of Creodonts they are short, wide, and split, indicating a more or less hoof-like claw, probably used for locomotion only. In the other they are like those of most modern Carnivores, sharp, laterally compressed, bearing apparently a sharp curved claw which could be used as a weapon. This character is known in the following:

No carnassial	*Arctocyonidæ*	*Clænodon* (both species)	Sharp-clawed.
Carnassial $\frac{p^4}{m_1}$	*Viverravidæ*	*Viverravus* (two species)	
" $m\frac{2}{3}$	*Hyænodontidæ*	*Hyænodon*	Blunt-clawed.
" $m\frac{1}{2}$	*Oxyænidæ*	*Oxyæna*, *Patriofelis*	
No carnassial	*Mesonychidæ*	*Pachyæna*, *Mesonyx*	

Thus, as far as it goes, this distinction coincides with that between the *Creodonta adaptiva* (carnassial $\frac{p^4}{m^1}$) and *Creodonta inadaptiva* (carnassial not $\frac{p^4}{m_1}$). *Arctocyon* must be included with the adaptive types and *Mesonyx* with the inadaptive, although they have no true carnassials, an arrangement which seems to be supported by a variety of minor skeletal characters. But the evidence is entirely inadequate at present to use this as a primary basis of division. Its constancy in both the small and large genera of a family has not been proved, and until this is proved it is always possible that the blunt claws are correlated with the size of the species, not with its true relationships.

Zittel ('94), following Schlosser and Scott in large part, divides the Creodonta as follows (I omit invalid or unimportant genera):

I. *Oxyclænidæ.* Molars tritubercular, pointed cusp, no shear; premolars trenchant. *Oxyclænus*, *Chriacus*, *Protochriacus*, *Tricentes*, *Mioclænus*, *Protogonodon.*

II. *Arctocyonidæ.* Molars quadritubercular, low-cusped, no shear; premolars trenchant. *Arctocyon*, *Clænodon*, *Anacodon.*

III. *Triisodontidæ.* Upper molars tritubercular, lower molars with two high cusps and talonid. No shear. Premolars high and pointed. *Triisodon*, *Goniacodon*, *Microclænodon*, *Sarcothrausten.*

IV. *Mesonychidæ.* Upper molars tritubercular, lower molars with high and low cusp and talonid. No shear. Premolars high and pointed. *Dissacus*, *Pachyæna*, *Mesonyx.*

V. *Proviverridæ.* Upper molars and $p^{\underline{4}}$ tritubercular, protocone far in and well forward. Lower molars with high tricuspid trigonid and low talonid. *Hyænodictis*, *Deltatherium*, *Sinopa*, *Proviverra*, *Quercytherium*, *Didelphodus*, *Prorhyzæna.*

VI. *Palæonictidæ.* Jaw shortened. Third upper and lower molar absent. Molars tritubercular, $p^{\underline{4}}$ and $m_{\overline{1}}$ large. Premolars thick. *Palæonictis*, *Amblyctonus*, *Patriofelis.*

VII. *Hyænodontidæ.* Upper molars with external blade and internal tubercle. Third upper molar transverse or absent. Lower molars sectional with low, trenchant heel. *Oxyæna*, *Protopsalis*, *Hemipsalodon*, *Pterodon*, *Dasyurodon*, *Thereutherium*, *Hyænodon.*

VIII. *Miacidæ.* $p^{\underline{4}}$ and $m_{\overline{1}}$ carnassial. Last upper molar small, transverse. *Miacis* (= *Uintacyon*), *Didymictis* (= *Viverravus*), ? *Vulpavus.*

The following changes, mainly dependent on recent discoveries, seem advisable:

Oxyclænidæ. *Mioclænus* is either Primate or Condylarth, *M. acolytus* certainly the former.[1] *Protogonodon* is Condylarth (although difficult to separate from *Protochriacus* in the lower dentition).

Triisodontidæ should, as Wortman suggests ('99, p. 146), be considered as a subfamily of Mesonychidæ.

Proviverridæ is a heterogeneous group of genera, chiefly unspecialized types of different phyla. I believe it can be broken up with advantage, the more primitive types being placed with the Oxyclænidæ, to which they are very close; the more advanced genera being distributed among the specialized families. *Hyænodictis* has the lower molars of the Mesonychidæ, but the upper teeth are like those of *Pterodon;* I am unable to see how the two styles of tooth could work together in the same jaw, and compelled to suggest incorrect association. *Deltatherium* is very close to *Chriacus* of the Oxyclænidæ. Some of the species of *Sinopa*, though not all, show the specialization of $\mathrm{m}\frac{2}{3}$ as carnassials, and all show characters, in the upper molars especially, allying them with either the Oxyænidæ or Hyænodontidæ. *Proviverra* is rather closer to *Sinopa* than to the Oxyclænidæ; *Didelphodus* and *Prorhyzæna* are unspecialized types with a leaning towards the *Sinopa* characters. *Quercytherium* seems to be a very aberrant Hyænodont.

Palæonictidæ. With this and the succeeding family an entire upset of the classification seems necessary, for *Patriofelis* is rather closely related to *Oxyæna*, which is very far from being closely related to *Pterodon* and *Hyænodon;* the resemblances between them are strictly parallelisms. We therefore divide these families as follows:

PALÆONICTIDÆ. $\mathrm{P}^{\underline{4}}$ and $\mathrm{m}_{\overline{1}}$ carnassial, posterior teeth disappearing. *Palæonictis*, *Amblyctonus*, *? Ælurotherium.*

OXYÆNIDÆ. $\mathrm{M}^{\underline{1}}$ and $\mathrm{m}_{\overline{2}}$ carnassial, posterior teeth disappearing. *Oxyæna*, *Patriofelis* (= *Protopsalis*), *Thereutherium*, *Telmatocyon.*

HYÆNODONTIDÆ. $\mathrm{M}\frac{2}{3}$ carnassial, $\mathrm{m}^{\underline{3}}$ disappearing. *Hyænodon*, *Pterodon*, *Quercytherium*, *Cynohyænodon*, *Sinopa*, *? Didelphodus*, *? Palæosinopa.*

"*Miacidæ.*"—Wortman and the writer have shown in a recent paper ('99, p. 110) that *Miacis* is a synonym of *Vulpavus* and

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[1] The primate skeleton from the Puerco described by Osborn and Earle in 1895, and referred to *Indrodon*, is *M. acolytus. M. turgidunculus*, *lemuroides*, *inæquidens*, *? opisthacus*, and *? turgidus* may also be placed provisionally among the Primates.

Didymictis of *Viverravus.* The name Miacidæ therefore cannot be used, although the family Viverravidæ there proposed by us may perhaps be extended so as to take in *Vulpavus* and *Uintacyon*, should these prove to have the Creodont carpus.

The analysis of the Creodonta on the primary basis of the specialized carnassial will stand thus :

I. CREODONTA PRIMITIVA. No specialized carnassial ; tritubercular upper and lower molars, shear rudimentary or absent. Claws unknown.

Oxyclænidæ. Includes some genera with Lemuroid affinities in the dentition.

II. CREODONTA ADAPTIVA. Carnassial when present on $p^{\underline{4}}$ and $m_{\overline{1}}$. Claws, where known, of modern type, and probably carried more or less free of the ground. Scapholunar-centrale early uniting (podials tending towards true Carnivore type).

1. Post-carnassial teeth disappearing.......................*Palæonictidæ.*
2. Post-carnassial teeth becoming tubercular...............*Viverravidæ.*
3. No carnassials, molars becoming flat-crowned, premolars disappearing ....*Arctocyonidæ.*

III. CREODONTA INADAPTIVA. Carnassial when present not on $p^{\underline{4}}$ and $m_{\overline{1}}$. Claws, where known, blunt, hoof-like, resting on the ground. No tendency to union of the carpals (podials tending towards Ungulate type).

1. Carnassials $m\frac{1}{2}$. Shearing teeth...........................*Oxyænidæ.*
2. Carnassials $m\frac{2}{3}$ " " ....*Hyænodontidæ.*
3. No carnassials, teeth with high, round, blunted cusps, upper molars tritubercular, lower molars premolariform................*Mesonychidæ.*

There is probably a definite correlation between the hoof-like claws and the lack of union among the carpals in *Oxyæna*, *Mesonyx*, and *Hyænodon ;* but that the division in foot-characters coincides with that based on carnassial specialization is not yet proven.

The Creodonta Adaptiva early gave rise to the true Carnivora (by union of the carpals), and are not known to have existed later than the Wasatch, although the Middle Eocene of *Vulpavus* and *Uintacyon* may, when the carpus is known, prove to be Creodonts. The Creodonta Inadaptiva persisted side by side with true Carnivora until the close of the Oligocene, but none of them can be admitted as ancestral to any true Carnivore, unless the supposition that has successively been raised about each of the three families, connecting them with the Pinnipedia, should be proven by satisfactory evidence.

Of the modern Carnivore families we may derive the Viverridæ, Canidæ and Procyonidæ, and perhaps the Mustelidæ, from the Viverravidæ ; the Felidæ and ? Hyænidæ probably from the Palæonictidæ ; the Ursidæ either from Arctocyonidæ or, with the Canidæ, from Viverravidæ—as discussed later in this paper.

As for the Pinnipedia, it appears to me that there is no evidence sufficient to justify our deriving them from any known type of Creodont or Carnivore, and that their ancestors are not very likely to be found in the almost exclusively terrestrial fauna of the fossil beds of the Bad Lands. (See also Osborn, '00.)

II.—Family VIVERRAVIDÆ *Wortman & Matthew.*

Viverravus *Marsh.*

Syn., *Didymictis* COPE.

"The lower jaws in this genus are long, very slender and compressed ; the last two molars are tubercular.[1] Both have the posterior part of the crown quite low and the anterior half elevated and composed of three angular cusps. The four teeth anterior to these[2] are much compressed. The upper flesh tooth closely resembles that in some of the Viverridæ, and the genus should probably be referred to that group."—*Marsh*, '72, p. 7, of separate.

"Inferior molars six, consisting of four premolars and two molars. True molars, a posterior tubercular and an anterior tuberculo-sectorial, *i. e.*, with three elevated cusps and a posterior heel. Premolars with a lobe behind the principal cusp. Canine teeth directed forward, and close together, so that it is doubtful whether there were any incisors. An ungual phalange of the typical species is strongly compressed. Humerus distally expanded transversely and margin pierced by humeral artery. Astragalus exhibits two entire trochlear faces, the wider external and directed interosuperiorly, the inner presenting superointeriorly. They are separated by an obtuse longitudinal angle and are little or not at all concave transversely. The form is depressed. The head supports a single transverse convex facet for the navicular, and with the neck is as long as the trochlear portion."—*Cope*, '84, p. 304.

A fragmentary skeleton found in the Big Horn Valley by the Princeton Expedition of 1884 was described by Prof. Scott ('87, p. 169) under the name of *Didymictis altidens.* As this species is not otherwise known to occur in the Wasatch, it is possible that the specimen should be referred to the closely allied *V.* (*D.*) *protenus.* Two somewhat more complete skeletons found in the Wasatch of the Big Horn Valley by the American Museum Expedition of 1896 further illustrate the genus, and by means of the information now available concerning other Creodonts we are able to summarize the characters of *Viverravus* as follows :

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[1] Meaning, apparently, with tubercular heel. The context favors this interpretation. Marsh apparently meant at this time to include in the genus forms like *Telmatocyon.*

[2] *I. e.*, premolars 1–4.

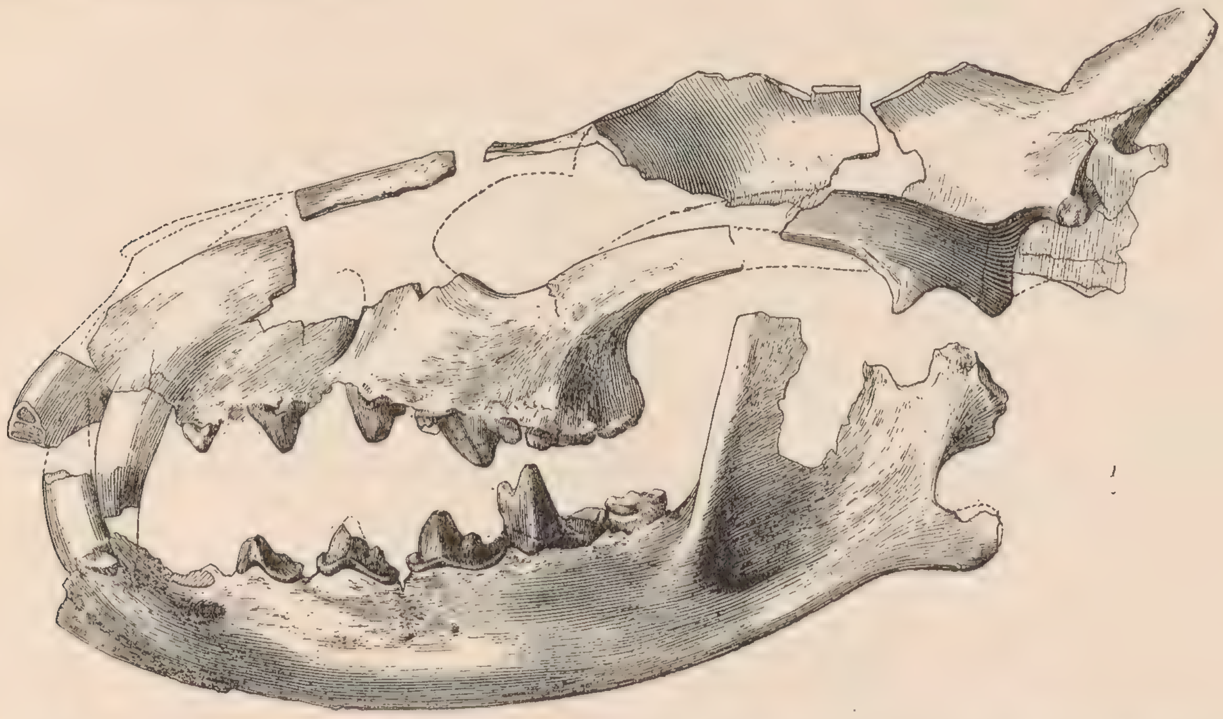

Fig. 1. *Viverravus protenus* Cope. Fragmentary skull and jaws, one-half natural size. No. 2830, Wasatch Beds, Big Horn Basin, Wyoming. Amer. Mus. Exp. 1896.

1.—General Creodont Characters.—Skull very large in proportion to skeleton, brain very small and of low type, tail large (presumably long), neck longer than in most modern Carnivora. Limbs rather short with large joints and heavy muscular attachments. Feet small, spreading, scaphoid and lunar separate. Fibula large, separate from tibia. Radius with oval proximal facet, and trihedral simply concave undivided distal facet. Part of a presternal bone preserved is like that of *Phenacodus wortmani*. Humerus with prominent deltoid crest reaching far down on the bone ; distal extremity broad, not deep, with entepicondylar foramen.

2.—Family and Generic Characters.— $\frac{p^4-m^1}{m_1}$ carnassials. Lower carnassial with high triangular trigonid shearing against posterior edge of $p^{\underline{4}}$ and anterior edge of $m^{\underline{1}}$, which are extended externally into shearing blades. Molars $\underline{1-2}$ tubercular, heel of $m_{\overline{1}}$ and all of $m_{\overline{2}}$ tubercular or becoming so, premolars trenchant with posterior cusps in front of heel. Jaws long and slender, incisors reduced and canines approximated. Femur with second trochanter interior instead of posterior, third trochanter well developed on external side, one fourth the length from the head of the bone. A clearly marked facet between fibula and calcaneum. Trochlea of astragalus very flat, distal facet strongly convex from above downward, almost flat transversely,

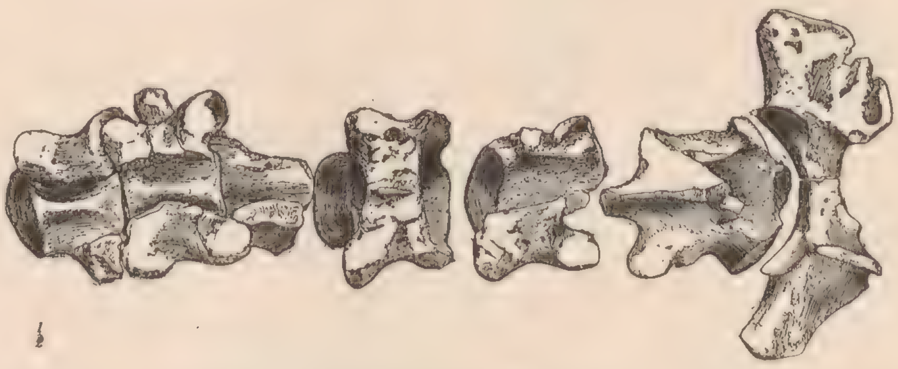

Fig. 2. *Viverravus protenus*, No. 2830. Cervical vertebræ, from above. One-half natural size.

neck rather long. Tarsals serial; a lunar facet on unciform. Entocuneiform deep, but remarkably short for a Creodont, not as long as the ectocuneiform. Toes 5–5, the first short and stout, not opposable. Claw phalanges compressed, sharp, without hood, middle phalanges asymmetrically excavated on upper side of shaft (? hence claws slightly retractile).

3.—GENERIC CHARACTERS.—Premolars $\frac{4}{4}$. Molars $\frac{2}{2}$. Trigonid of $m_{\overline{1}}$ very high, with antero-external and posterior shearing surfaces. Postero-external shearing blade of $p^{\underline{4}}$ and antero-external blade of $m^{\underline{1}}$ strongly developed.

4.—SPECIFIC CHARACTERS of *V. protenus* and *V. leptomylus* var.—These two species are distinguished from all others of the genus by the elongate low tubercular $m_{\overline{2}}$ with very small trigonid and very long heel. The teeth of *protenus* and *leptomylus* var. show no very constant differences, but may be separated more or less completely on the following characters (averaged from a number of specimens):

	V. leptomylus var.	*V. protenus.*
Length $p_{3-4} : m_{1-2}$	mm. 20.3 : 19.1 = 1.06	25.9 : 21.4 = 1.21
" $p^4 : m^{1-2}$	11.5 : 14.2 = 0.81	14.5 : 16.7 = 0.88
Blade p^4 to length	4.6 : 11.5 = 0.40	6.1 : 14.5 = 0.42
Transv. to longit. diam. $m^{\underline{1}}$	11.8 : 8.1 = 1.45	15.3 : 10.1 = 1.52

The above proportions show *V. protenus* as nearly one fourth larger, with the premolars larger in proportion, somewhat longer shearing blade on $p^{\underline{4}}$, and $m^{\underline{1}}$ more extended transversely. The same character and extent of distinctions are found between different species of Canidæ, but they are much more constant.

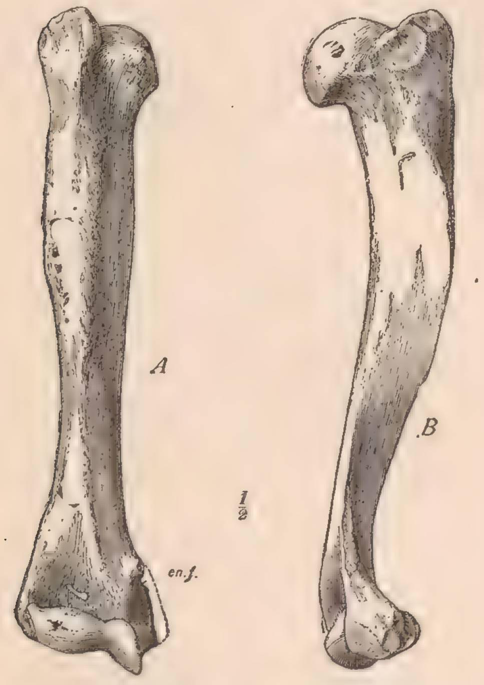

Fig. 3. *Viverravus protenus*, No. 2830. Right humerus; *A*, from in front; *B*, from outside. One-half natural size.

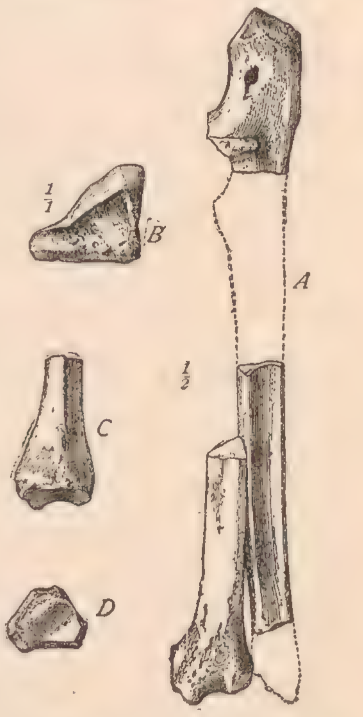

Fig. 4. *Viverravus protenus*, No. 2830. *A*, parts of left radius and ulna, from in front; *B*, right unciform, from in front; *C*, posterior view, and *D*, distal view of distal end of radius. One-half natural size, except *B*, which is natural size.

In the skeleton some striking differences in proportion appear. *V. protenus* has limb bones of the same length as *V. leptomylus* but averaging nearly a third stouter (the dentition of *V. protenus* being one fourth larger). The modern Civet, intermediate between the two in size of skull, has limb bones one fourth longer than the larger species, and stouter in proportion, while the neck is over one half longer.

The cat, in which the back and upper limb-bones are of nearly the same size and the lower limb bones considerably longer, has a head and jaws of about half the dimensions of *V. protenus*, and much shorter neck.

The following table[1] will give an idea of the proportions of these animals :

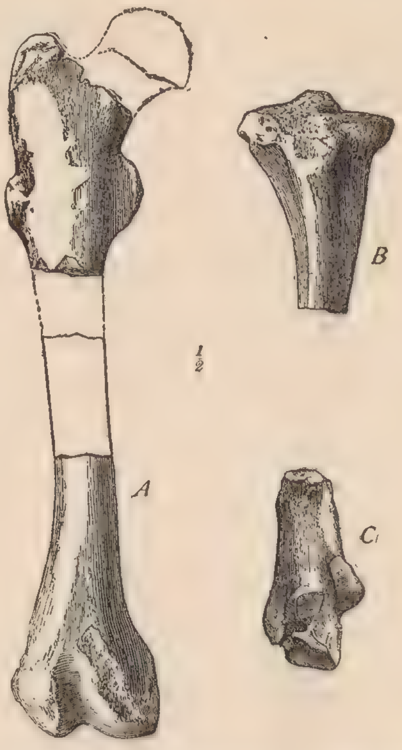

Fig. 5. *Viverravus protenus*, No. 2830. *A*, parts of right femur, from in front ; *B*, proximal end of right tibia ; *C*, left calcaneum. One-half natural size.

	Viverravus protenus.	*Viverravus leptomylus* var.	*Viverra civetta.*	*Felis catus.*
Humerus, length	94	e.89	117.6	97
" circumference of shaft	27.5	21.5	34.7	25
" diameter of distal end	21			19
Femur, length	e.97.5	97	136	103
" circumference of shaft	27	21	36	26
Radius, length		63	103	91
" circumference of shaft	17	12		
Ulna, length		85.5	131.4	104
" circumference of olecranon	30	23.2		
Calcaneum, length	27	22.5		29
Tarsus, length (including calcaneum)		29		
" width across navicular and cuboid		12.6		
Skull, length	167.5		158	91
Jaw, length	130		111.2	63
Dentition, length	83.7	e.66.4	75	34
Seven cervical vertebræ, length	102		164	

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[1] The measurements are given in millimetres. e = estimated.

III.—Family ARCTOCYONIDÆ (*Gervais*) *Cope.*

The Manus and Pes of Clænodon.

In a previous article ('97, p. 289) I have given some account of the foot structure of this interesting Creodont, now more fully known than when first described by Cope ('83, p. 547). This description can now be supplemented by figures of the fore and hind feet.

It was mainly on the characters of *Clænodon* (*Mioclænus*) *ferox* that Professor Cope based his views as to the position of the genus *Mioclænus* Cope ('84, p. 324), referring it to the Arctocyonidæ, which included this and many other species of divergent affinities, separated by Scott ('92) as distinct genera. Judging from Cope's descriptions of the skeletal material of *M. ferox* at his command, he was evidently strongly impressed with its resemblance to Marsupials, an idea which led him astray in parts of his description. I do not think that this resemblance is wholly a case of parallelism, for all the Creodonta of the Basal Eocene were quite nearly allied, and certain of them show primitive marsupial characters that it is very difficult to explain without admitting a closer connection between Marsupials and Placentals than their modern differentiation would lead one to believe. *Clænodon* has, however, no marsupial characters except such as must be considered an inheritance from the common stock which gave rise to both Marsupials and Placentals. Its progressive characters are placental carnivore.

Several genera of this group have been described. Without discussing the validity of *Hyodectes* and *Heteroborus*, defined by Cope on the basis of descriptions of European Arctocyons, we may say that three genera are sufficiently known for discussion of their relationships. These are :

Arctocyon Blv., type *A. primævus* Blv.; referred species, *A. gervaisi*, *A. deulii* Lem., all Basal Eocene of Europe.

Anacodon Cope, type *A. ursidens* Cope, Lower Eocene of America.

Clænodon Scott, type *C.* (*Mioclænus*) *ferox* Cope ; referred species, *C. corrugatus* (Cope), Basal Eocene of America.

To these should perhaps be added *Arctocyonides* Lem., type *A. sp. innom.* Lem., Basal Eocene of Europe ; referred species?

A. (*Mioclænus*, *Clænodon*) *protogonioides* Cope, Basal Eocene of New Mexico.

The last genus is distinguished only by the smaller quadrate teeth—simpler than those of *Clænodon* if the reference of *Mioclænus protogonioides* be correct. The type species is little known.

If the foot bones figured by Osborn ('90, p. 60) are correctly referred to *Arctocyon*, there are important differences in foot-structure between it and *Clænodon*, the former having no fibular facet on the calcaneum, while the ungual phalanx is much less compressed. The figure given by Lemoine ('78, pl. IV) of a calcaneum of *A. gervaisi*, is much more like those of *Clænodon ferox* and *C. corrugatus* and appears to indicate a fibular facet. I think it probable that the bones figured by Osborn are those of some other Creodont. The skeletal structure of *Anacodon* is unknown.

The dental distinctions are :

Clænodon.	*Arctocyon.*	*Anacodon.*
Upper premolars moderately reduced, the first one-rooted, second two-rooted, third and fourth three-rooted with high trihedral protocone and weak cingular cusps at the bases of the three solid angles.	*Upper premolars* considerably reduced, first one-rooted, second and third two-rooted, fourth large with strong deuterocone.	*Upper premolars* much reduced, the first and second minute or absent, third two-rooted, fourth small with a strong deuterocone and rudimentary third and fourth cusps.
Upper molars with three low subequal cusps, strong metaconule, somewhat weaker hypocone and very small paraconule. Metaconule weak and hypocone absent on $m^{\underline{3}}$.	*Upper molars* as in *Clænodon.*	Molar cusps obsolete.

These distinctions are based on the typical species of each genus. It is probable that the other species referred to *Arctocyon* are closer to *Clænodon*, but the present evidence seems to warrant holding the three genera separate. *Arctocyonides* if correctly represented by the American species *A.* (*Mioclænus*, *Clænodon*) *protogonioides* (Cope) is the most primitive of the family, but hardly deserves more than subgeneric separation from *Clænodon.*

This genus, while close to *Arctocyon*, is distinctly less specialized, and the differences seem to warrant generic separation. *Anacodon*, of the Wasatch, is much more specialized than any of the Basal Eocene species. All the genera, as far as known, have long, sharp, serrate canines, somewhat flattened and very little worn, premolars in various stages of disuse and reduction, molars becoming flat-topped and quadrate. The little-used premolars and canines may be contrasted with those of the Mesonychidæ and Oxyænidæ, in which they were well worn, often to enamelless stumps. The canines may have been chiefly for defense against enemies, the animal not being to any extent carnivorous.

The fore and hind feet here figured are of much interest, showing for so early a period an unusual degree of specialization in certain characters.

The Fore Foot.

The carpus is distinguished especially by the large rectangular *centrale*, lying half under the lunar, half under the scaphoid and *fused to the latter bone.* The lunar-centrale facet still persists but the lunar-scaphoid facet has disappeared, replaced by a roughened bony surface; this probably points to an approaching union of scaphoid and lunar. The *lunar* is keeled, and faceted for centrale and magnum on one side, for unciform on the other. The *magnum* has a broad centrale facet and narrow lunar facet separated by a sharp keel. This arrangement would, upon union of the scapho-centrale and lunar give a proximal keeled facet on the magnum fitting into a correspondingly grooved facet on the

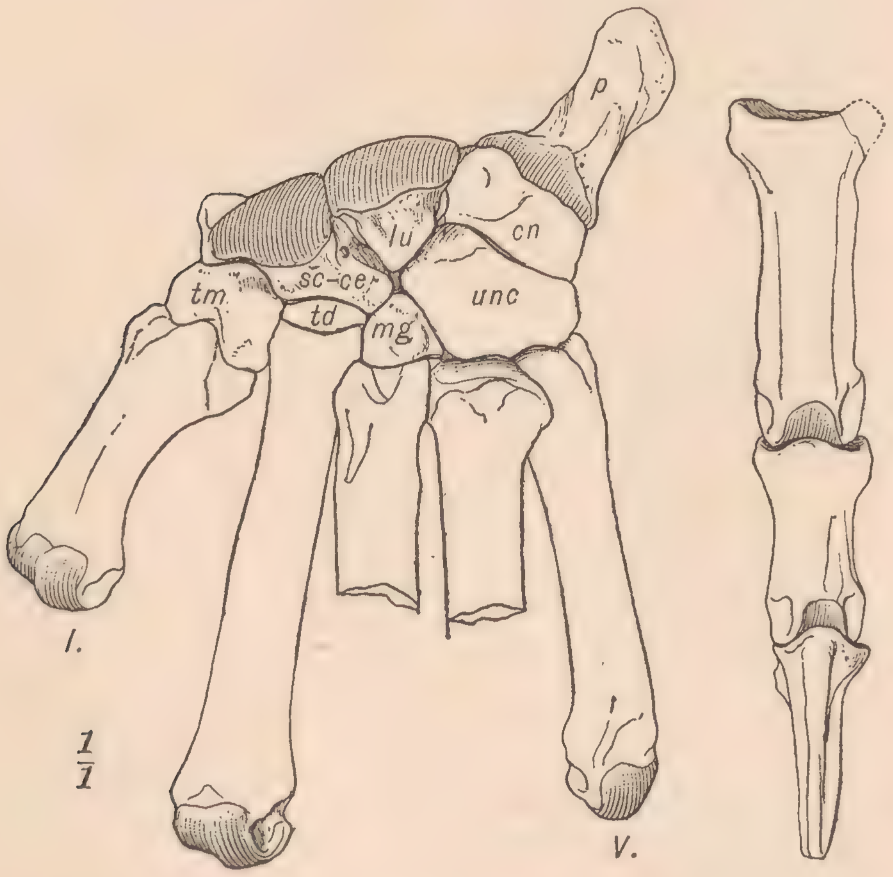

Fig. 6. *Clænodon corrugatus* (Cope). Fore foot, natural size. Specimen No. 2456. Torrejon Beds, Wyoming.

scapholunar, exactly as is found among Ursidæ, instead of a flat facet such as characterizes Canidæ and Felidæ.

The *unciform*, *cuneiform*, and *pisiform* are of the usual primitive type, the former having a broad lunar facet separated by an angle from that for the cuneiform. The *trapezoid* has not been found, but was evidently small, ovate, with a narrow facet for the magnum and pinching out on the radial side so as barely to touch the trapezium. The *trapezium* is large with triangular upper surface and projects in a blunt point underneath the centrale and trapezoid.

There are five *metacarpals*, the first only two thirds as long as the rest, but stout in proportion, and divergent though hardly opposable. Its proximal facet allowed considerable play, and is keeled toward its superior surface. The other metacarpals are narrower, longer, and much closer together, with but little play on the carpus.

The *phalanges* are keeled about as in the bears, a little curved and somewhat angulate in section. The *ungual phalanges* are more specialized than in any known Creodont and the majority of Carnivores. They are large, high, and much compressed, quite as much so as in Ursidæ but with no trace of basal sheath.

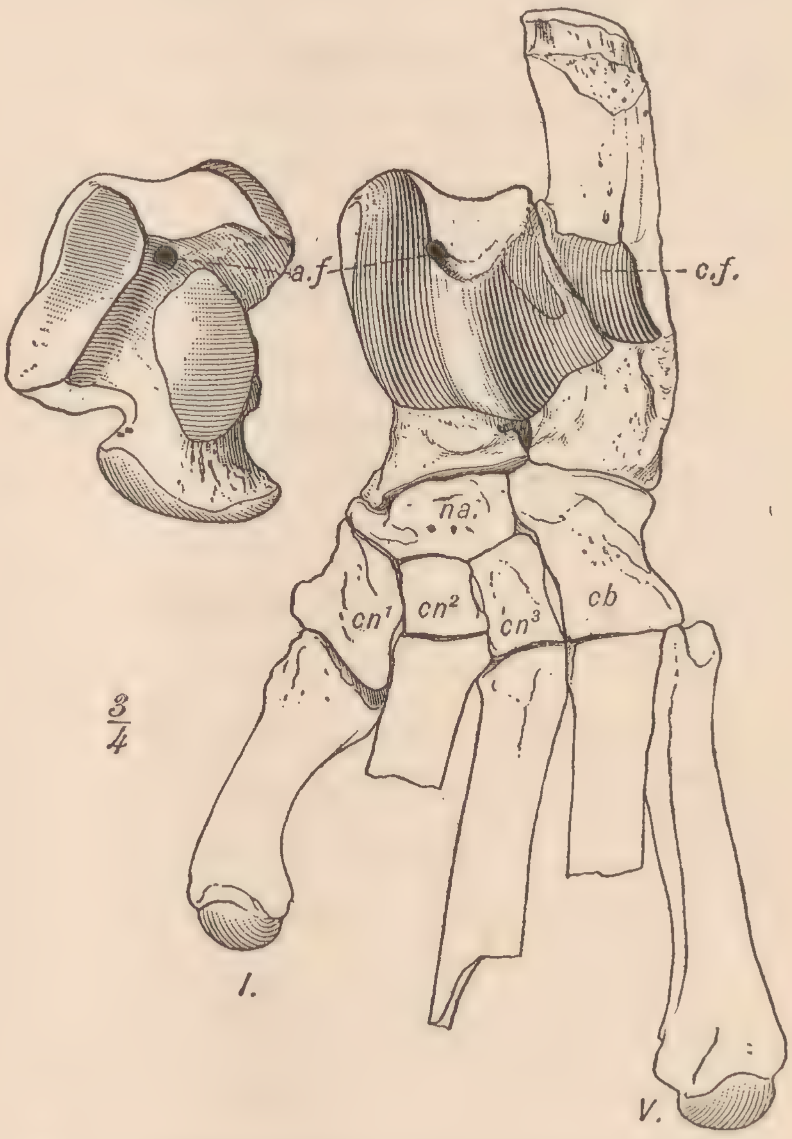

Fig. 7. *Clænodon ferox* (Cope). Hind foot, three-fourths natural size. Type specimen No. 3268. Torrejon Beds, Wyoming.

The Hind Foot.

The *tarsus* shows some interesting characters. The tibial and fibular articulating surfaces are of nearly equal width, and the fibula has a considerable facet on the calcaneum. The ectal astragalo-calcanear facet is oblique as is usual among the earlier

Creodonts, and is separated by a slight angle from the fibulo-calcanear facet. The trochlea of the astragalus is very shallow, the foramen[1] is present, and the notch for the flexor digitorum wide though not very deep. The head of the astragalus is considerably flattened, about as much as in Ursidæ or Felidæ. The *cuboid* has a rather narrow astragalar facet, concave, and separated by an angle from the rather flat calcanear facet. The corresponding facet on the astragalus is not separable from the navicular facet. The *entocuneiform* is large and *metatarsal I* short, stout, and divergent, though with less play than the corresponding metacarpal. The other four metatarsals are of about equal length, the second being wedged in proximally between the ecto- and ento-cuneiforms.

Comparisons.

The union of the centrale with the scaphoid is an interesting stage in the consolidation of the carpus. The position and size of the centrale are peculiar. In *Mesonyx* it lies entirely beneath the scaphoid (Scott, '87, p. 161, pl. VII, fig. 1). In *Dissacus* (Osborn and Earle, '95, p. 33, fig. 9) it is less completely so, but the shape is rhombic instead of rectangular. In *Hyænodon* (Scott, '87, p. 182, pl. VII, fig. 5) the centrale lies partly under the lunar, but is small and triangular, hardly touching the magnum, while the trapezoid is very large, and the unciform has no lunar facet. In *Oxyæna* the carpus is less strongly interlocking, the centrale smaller and rhombic, trapezoid larger, trapezium different in shape. In *Viverravus* the carpus is narrower, foot probably slenderer—little is known as to the arrangement of the carpals. Comparing this carpus with the various primitive Creodonts, Condylarths and Amblypods, shows a great deal of similarity among them all. The progressive characters in *Clænodon* seem to be :

1. Union of centrale with scaphoid ; ? large size of centrale, almost excluding magnum from lunar on upper surface ; sharp keel of magnum.
2. Grooving and inward facing of distal facet of trapezium.
3. Stout semi-opposable first metapodial, and length of fifth.

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[1] The use of this foramen seems to be unknown. Prof. Osborn has suggested that it may have held an extension of the interosseous ligament, which lies between the two astragalo-calcanear facets and connects the astragalus with the calcaneum. If this ligament originally passed up to the tibia, its disappearance would be directly connected with the keeling of the proximal and flattening of the distal end of the astragalus, all being due to the transference of the main ankle-joint from the distal to the proximal end of the astragalus, *i. e.*, the evolution of the mammal from the reptilian stage of development in this character.

4. High compressed claw; extension upward of distal facets of 1st and 2d phalanges and to some extent of distal metapodial keels.
5. Slender, serrate, unworn canines.
6. Reduction of premolar dentition.
7. Low-cusped quadrate molars, m_3 somewhat reduced.

The first of these characters leads towards the Carnivora generally, except the sharp-keeled magnum, which seems to point especially towards the Bears. It may, however, be merely the additional brace required for large-clawed feet. The semi-opposed thumb is a character pointing towards arboreal types, hardly to any known Ursidæ. The proportions of the phalanges agree with those of the Ursidæ and of some other Carnivora (*Procyon*, etc.). The high compressed claw-phalanx suggests the Ursidæ very strongly; the greater extension of the facets is a modernization common to all the sharp-clawed types.

In the dentition all three characters point to the Ursidæ and to no other Carnivora. The elongation of the second molar after the disappearance of the first is exactly paralleled by the Raccoons in evolving from the Canidæ through *Phlaocyon* — a very similar adaptation not carried so far as in the Ursidæ.

The argument for placing the Arctocyonidæ ancestral to the Ursidæ is, then:

1. They belong by their foot structure to the adaptive Creodonta, the teeth not placing them in either the adaptive or inadaptive group.

2. The three chief progressive characters of the teeth are those which distinguish the bear dentition.

3. The claws are far advanced towards the type found in the Ursidæ and in hardly any other Carnivora.

4. The one marked distinction that I can see to separate the bear-carpus from that of other Carnivora is found in process of formation in *Clænodon.*

5. The proportions of the digits show a specialization found in the Bears and in hardly any other Carnivora.

Against this may be urged:

1. *Clænodon* has the thumb more opposable than in the modern Ursidæ.

2. *Anacodon* has the premolar dentition as much reduced as in the modern Ursidæ.

(In either case, this may indicate that neither *Clænodon* nor *Anacodon* is precisely in the line of Bear descent, but does not seriously weaken the arguments given above as to the derivation of the Bears from the family Arctocyonidæ.)

3. The real objection to the theory lies in the remarkable approximation of certain of the Dog and Bear families in Upper Miocene time. Although, as Schlosser has recently shown, *Hyænarctos* and *Amphicyon* cannot stand in the direct line of descent, yet they exhibit a striking gradation between the two families and might well be considered as survivals of primitive links connecting the two. *Cephalogale* also, among the more ancient Canidæ, shows several approximations to the Ursidæ, and is placed by Dr. Schlosser as ancestral to the family ('99, 146).

There are some characters, however, that have not been bridged, and these are perhaps more important than they appear at first sight.

1. All Canidæ have triangular upper molars. All Ursidæ have quadrate upper molars.

2. All Canidæ have the inner cusp of $p^{\underline{4}}$ anterior. All Ursidæ have it medial.

The trigonal molar and the anteriorly placed trittocone are indications of a formerly tuberculosectorial dentition, and apparently very difficult to get rid of. *Procyon*, however, seems to show us an earlier stage of their disappearance in a line descended from the Canidæ; so that we may yet discover the intermediate stages in the Ursid phylum.

To sum up—the *Arctocyons* were progressing towards the Bear line in all the most distinctive characters of both teeth and feet. But the wide gap between Lower Eocene and Middle Miocene makes any connection between the two somewhat uncertain. In the Canid line, on the other hand, we have a number of apparently intermediate stages known. But these intermediate stages cannot have been actually in the line of descent, and even if they are unaltered descendants of more ancient types we still have a gap of some importance unbridged. The connection, moreover, is based on teeth alone. Professor Osborn, in discussing the evolution of the Mammalia, remarks: "The teeth and feet, owing to the frequent parallels of adaptation, may wholly mislead us if taken alone; while if considered together they give us a sure key; for no case of exact parallelism in both teeth and feet between two unrelated types has yet been found or is likely to be." (*Osborn*, 1893, p. 10.) If *Clænodon* be totally unrelated to the Ursidæ it is an exception to this statement, and, as far as I recall, the only one. And yet the evidence is very strong for deriving the Ursidæ from primitive Dogs.

IV.—Family HYÆNODONTIDÆ *Cope.*

In this family are included, as Wortman has already indicated ('99, p. 139), most of the genera grouped by Schlosser under the name Proviverridæ. *Deltatherium* belongs with the Oxyclænidæ; the position of *Didelphodus* and *Palæosinopa* is uncertain, as they fail to show the progressive characters of either group. *Sinopa* and *Cynohyænodon* clearly belong in it, *Proviverra* somewhat less clearly, while *Quercytherium* appears to be an aberrant member. The progressive characters of the two families may be contrasted thus:

Hyænodontidæ.	*Oxyclænidæ.*
Upper molars with connate external cusps, developing a shear, especially between $\mathrm{m}^{\underline{2}}$ and $\mathrm{m}_{\overline{3}}$. Last upper molar becoming transverse and disappearing. Heels of lower molars disappearing, $\mathrm{me}^{\underline{d}}$ disappearing, $\mathrm{pa}^{\underline{d}}$ advancing to form a cutting blade. Dentition functionally carnivorous (*cf.* Felidæ).	Upper molars becoming quadrate. Fourth lower premolar becoming molariform. A considerable diastema developing behind canines with disappearance of $\mathrm{p}\frac{1}{1}$. Dentition functionally insectivorous (*cf.* Lemurs, Opossums, and some Insectivores).

All the above Hyænodont characters are exhibited to a greater or less extent by various species of *Sinopa*, though always in an early stage of progress. Most of them are exhibited by *Cynohyænodon* and *Proviverra*, which besides are extremely close to *Sinopa*. The same is true of *Quercytherium* except for the very peculiar premolars (which are approximated in *Cynohyænodon minor* if the reference to this species be correct of a fine specimen in the Paris Museum). *Palæosinopa* and *Didelphodus* can be placed here only on account of general resemblance to the Proviverrines and lack of the progressive characters of any other group. The generic definitions will be:

Hyænodon. $\mathrm{M}^{\underline{3}}$ absent; m^{1-2} without protocone, para- and metacone united; metastyle forming a shearing blade larger than the united *pa.* and *me.*; m_{1-3} without metaconid or heel. Jaw long, slender.

Pterodon. $M^{\underline{3}}$ transverse reduced ; m^{1-2} triangular with well-developed protocone, *pa.* and *me.* connate, metastyle blade smaller ; m_{1-3} without metaconid but with small trenchant heel. Jaw short and deep.

Sinopa. $M^{\underline{3}}$ transverse ; m^{1-2} sharply triangular with widely separated protocone, *pa.* and *me.* connate to varying degree, metastyle and parastyle extended into small shearing blades. M_{1-3} with high triangular trigon and low basin heel, $pa^{\underline{d}}$ and $me^{\underline{d}}$ of equal size, $pr^{\underline{d}}$ much higher.

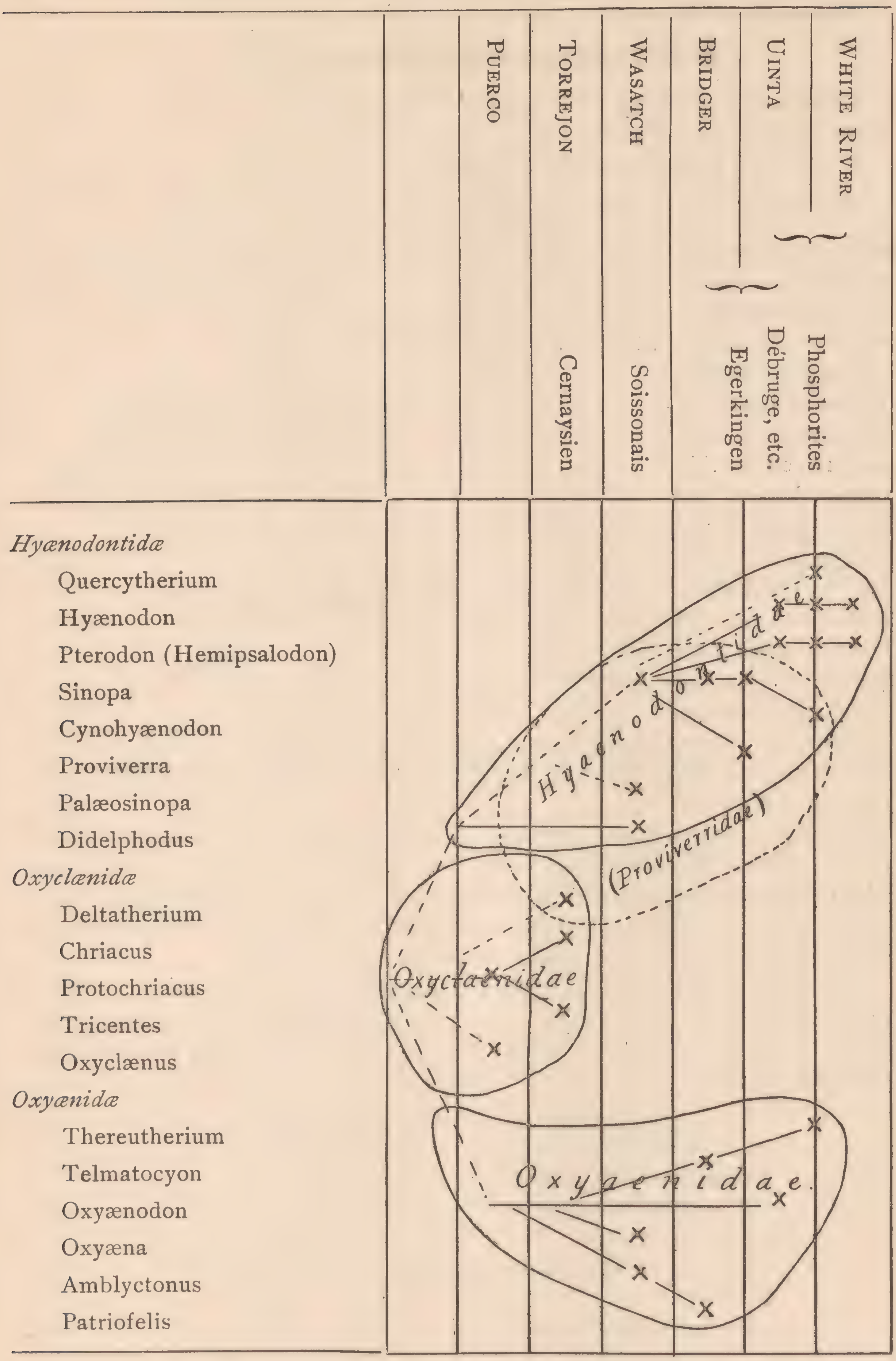
Didelphodus. $M^{\underline{3}}$ subtransverse unreduced. M^{1-2} sharply triangular with widely separate crescentic protocone, *pa.* and *me.* somewhat connate, para- and metastyles moderately developed. Lower molars with triangular trigonid of three equal cusps ($pa^{\underline{d}}$ internal), and large heel.

Palæosinopa. $M^{\underline{3}}$? subtransverse ; m^{1-2} somewhat quadrate, external styles not much developed. Lower molars with low trigonid of three equal cusps ($pa^{\underline{d}}$ anterior) and large bicuspid basin heel.

Quercytherium. Molars much as in *Sinopa.* Premolars distinguished by extreme robustness and large size, $p\frac{2}{2}$ being the largest.

The genera *Limnocyon* Marsh, *Stypolophus* Cope, and *Prototomus* Cope are, as Scott holds, synonyms of *Sinopa* Leidy, except *L. riparius*, subsequently (Marsh, '99) separated under the name *Telmatocyon.* *Triacodon* Marsh is perhaps founded on incomplete molars of either *Sinopa* or *Viverravus.* The species placed in it by Cope in 1872 was afterwards correctly referred by him to *Stypolophus.* *Proviverra* is very close to *Sinopa*, but, though very imperfectly known, seems to differ from any of the species of *Sinopa* in its short jaw and reduced premolar region, approximating *Prorhyzæna.* *Cynohyænodon cayluxi* is hardly distinguishable in dentition from *Sinopa*, but seems to be somewhat more advanced in skull characters. It is hardly worthy of generic separation. *C. minor*, if correctly represented by the upper and lower jaws referred to it in the Paris Museum, is more nearly allied to *Quercytherium*, having the same proportions in the premolars, which, however, are not nearly so robust. *Hemipsalodon* does not seem separable from *Pterodon;* and *Pseudopterodon*, according to Scott, is probably founded on milk teeth of *Pterodon* (Scott, '92). *Thylacomorphus* is known only by the back of a skull described by Prof. Gervais in 1876, but not figured. It was conjecturally referred by Schlosser to *Cynohyænodon.* It is, however, not a Creodont at all, but an Anoplothere, probably *Diplobune quercyi.*

The accompanying table will show the conception which this paper attempts to explain of the relationship of the genera and limits of the families of Inadaptive Shear-toothed Creodonts, the Oxyænidæ, Oxyclænidæ, and Hyænodontidæ :


PUERCO
TORREJON
Cernaysien
WASATCH
Soissonais
BRIDGER
Egerkingen
UINTA
Débruge, etc.
WHITE RIVER
Phosphorites
Hyænodontidæ
Quercytherium
Hyænodon
Pterodon (Hemipsalodon)
Sinopa
Cynohyænodon
Proviverra
Palæosinopa
Didelphodus
Oxyclænidæ
Deltatherium
Chriacus
Protochriacus
Tricentes
Oxyclænus
Oxyænidæ
Thereutherium
Telmatocyon
Oxyænodon
Oxyæna
Amblyctonus
Patriofelis
Hyaenodontidae
(Proviverridae)
Oxyclaenidae
Oxyaenidae

Palæosinopa veterrima, n. g. et sp.

Palæosinopa veterrima "Wortman," MATTHEW, Bull. Amer. Mus. Nat. Hist., 1899, p. 31. Name only.

Stypolophus whitiæ OSBORN & WORTMAN, '92, p. 110, not *S. whitiæ* Cope.

Generic characters: Dentition $\frac{3\cdot1\cdot4\cdot3}{3\cdot1\cdot4\cdot3}$. Metastyle moderately extended on m^2, rudimentary on m^1. Trigonid of three subequal cusps; heel larger than trigonid, hy^d and en^d strong, hl^d present on all molars, strong only on $m_{\overline{3}}$. The worn state of the upper molars in the type specimen precludes exact comparison with *Didelphodus*, to which the genus is most closely allied.

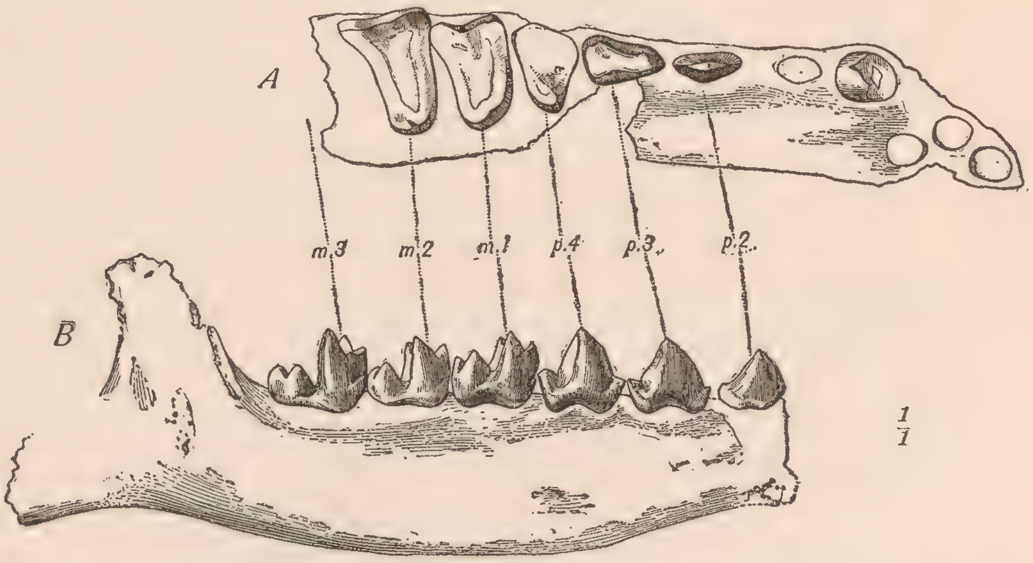


Fig. 8. *Palæosinopa veterrima* Matthew. *A*, upper jaw, from below, type specimen, No. 95; *B*, external view of lower jaw, cotype, No. 150*a*. Both natural size, from the Wasatch Beds, Big Horn Basin, Wyoming. Amer. Mus. Exp. 1891.

Specific characters: Upper incisors rather large, roots not compressed, the third placed behind and within the second, leaving a deep notch for the lower canine between i^2 and c^1. Canines rather small, first upper premolar one-rooted, second two-rooted, third two-rooted, but with the posterior root the wider, crown with robust protocone and rudimentary postero-internal heel; fourth three-rooted with well-separated internal cusp. First and second molars with rudimentary hypocone or postero-internal cingulum, third molar transverse apparently large. First lower premolar one-rooted, others two-rooted, trenchant, with small heels and minute anterior basal cusps.

Type No. 95, upper and lower jaws, teeth badly worn. Associated type, No. 150*a*, a lower jaw with unworn teeth. Referred specimens Nos. 2849, 2851, 2852. All from the Lower Eocene Wasatch Beds of the Big Horn Valley, Wyoming.

Measurements of Type Specimen.

Upper dentition (approximate) i^1m^3	49		
" molars (approximate)	15		
" premolars "	21		
First upper molar, antero-post.	5.3	transv.	7.4
Second " " "	8	"	8.1
Lower dentition, c_1-m_3	41		
" true molars	16.6		
" premolars	18		
Depth of jaw below p_2	6		
" " " " m_2	12		

Palæosinopa didelphoides (*Cope*).

Ictops didelphoides COPE, Bull. Hayden Survey, VI (1881), p. 192; Tert. Vert., p. 268.

Palæictops didelphoides MATTHEW, '99, p. 35.

The lower jaw fragment from the Wind River Beds, referred to *Ictops* by Prof. Cope, more probably belongs in this genus. In absence of characteristic parts its reference is provisional.

Sinopa *Leidy*, 1871.

Stypolophus COPE, Pal. Bull. No. 2, Proc. Am. Phil. Soc. 1872, 466.

Prototomus COPE, Report on Fossil Vert. N. M., Ann. Rep. U. S. G. S. W. of 100th Mer., 1874.

Limnocyon MARSH, in part, Am. Journ. Sci. 1872, Vol. IV, p. 122.

The original types of *Sinopa*, *Stypolophus*, and *Limnocyon* were from the Middle Eocene of Wyoming. Cope afterwards described a number of species from the Wasatch under the name of *Prototomus*, which he afterwards (1877) united with *Stypolophus*. Scott (1892) united both with *Sinopa*, and an examination of the types of *Limnocyon* shows that they also should be referred to this genus.

Besides the characters given on a previous page the following may be noticed:

Dentition $\frac{3\cdot1\cdot4\cdot3}{3\cdot1\cdot4\cdot3}$. First premolar two-rooted. Brain small. Lower premolars composed of principal cusp and trenchant heel (no second posterior cusp). *Me.* of $\mathrm{m}^{\underline{2}}$ reduced or absent. Incisors small, the upper ones in a row.

Sinopa rapax *Leidy*, 1871.

From the Bridger Beds, Wyoming. Type, a lower jaw with more or less broken molars, figured in Extinct Vert. Western Terrs. The species is of medium size with apparently a rather large heel on $\mathrm{m}_{\overline{1}}$, but with vestigial heel (*fide* Cope, '84, p. 289) on the third. I am unable to find other specific characters in Leidy's figure. Length of $\mathrm{p}_{\overline{4}}$–$\mathrm{m}_{\overline{3}}$, 31mm.

Sinopa vera (*Marsh*).

Limnocyon verus MARSH, Am. Jour. Sci. 1872, Vol. IV, p. 122.

From the Bridger Beds, Wyoming. A large species with protocones of $\mathrm{m}^{\underline{1}}$ and $\mathrm{m}^{\underline{2}}$ much compressed. Third premolar narrow and trenchant. Length of $\mathrm{p}_{\overline{4}}$–$\mathrm{m}_{\overline{3}}$, estimated, 40mm.

Sinopa agilis (*Marsh*).

Limnocyon agilis Marsh, Am. Jour. Sci. 1872, Vol. IV, p. 202 (published Aug. 7).

Stypolophus brevicalcaratus Cope, Pal. Bull. No. 3; Proc. Am. Phil. Soc. 1872, p. 469 (published Aug. 7); Tert. Vert., p. 291, pl. xxiv, fig. 9.

From the Bridger Beds, Wyoming. I have preferred Prof. Marsh's name for this species as based on a much more complete specimen, including upper and lower teeth and many parts of the skeleton. The type of *S. brevicalcaratus* is a fragment of the lower jaw with m_{2-3}. Prof. Cope's determination of the teeth as m_{1-2} is, I think, incorrect.

This species, of medium size, is very close to *S. whitiæ* but may be distinguished by the smaller heels of the lower molars, especially of $m_{\overline{3}}$. It may prove to be identical with *S. rapax* Leidy.

Sinopa pungens (*Cope*).

Stypolophus pungens Cope, Pal. Bull. No. 2; Proc. Am. Phil. Soc. 1872 (Vol. XII), p. 460 (Aug. 3); Tert. Vert., p. 291, pl. xxiv, fig. 8.

Type of the genus *Stypolophus*. Bridger Beds, Wyoming. A rather primitive species of medium size with long tricuspid heel on $m_{\overline{3}}$, approaching *Palæosinopa*. Trigon not very high. Represented by a lower jaw fragment, No. 5015, Cope Collection, Amer. Mus. Nat. Hist.

[? Sinopa insectivora (*Cope*).]

Stypolophus insectivorus Cope, Pal. Bull. No. 3; Proc. Am. Phil. Soc., Vol. XII, 1872, p. 469.

Bridger Beds, Wyoming. The type of this species has been lost or mislaid and its position in the genus cannot now be determined. Prof. Cope's figures in Tertiary Vertebrata are evidently incorrect, the outline of the tooth as viewed from within and from without being different.

[Sinopa aculeata (*Cope*.)]

Triacodon aculeatus Cope, Pal. Bull. No. 1; Proc. Am. Phil. Soc. 1872, Vol. XII, p. 460.

Stypolophus aculeatus Cope, Ext. Vert. N. M. Rep. Wheeler Survey, IV, ii, 112. Not *S. aculeatus*, Tert. Vert., p. 299.

Bridger Beds, Wyoming. This species was founded on part of the crown of a lower molar, subsequently lost or mislaid, and the tip of a premolar crown. It is indeterminate specifically, generically or even in family, and the name has no standing. The upper and lower jaws in the Princeton Museum figured and referred to this species by Prof. Cope in 1884 more probably belong to *S. strenua.*

Sinopa hians (*Cope*).

Stypolophus hians COPE, Rep. Wheeler Survey, Vol. IV, pt, ii, p. 118, pl. xxxviii, figs. 12–20.

Wasatch of New Mexico and Wyoming. The type is an extremely fragmentary and badly preserved skeleton from the Wasatch of New Mexico. The anterior premolars are spaced and the last two lower molars subequal. Fourth premolar wider posteriorly. The other characters given by Prof. Cope are common to the genus.

The most important distinctive character seems to be the subequal second and third molars. On this ground I place here No. 2850 Amer. Mus. Coll., which agrees fairly well in size, has the anterior premolars somewhat less spaced, and a narrower heel to $p_{\overline{4}}$. It is a young individual, with teeth scarcely worn, hence perhaps the less spacing of the premolars. It consists of upper and lower jaws, fragments of the skull, a few vertebræ, and parts of nearly all the limb bones.

Third lower molar as large as second, first considerably smaller. Angle between anterior and posterior shear of lower trigonids averaging 45°. Incisors present but number uncertain. Metastyle on $p^{\underline{4}}$ small. *Pa.* and *me.* rather closely connate. $M^{\underline{3}}$ considerably reduced with vestigial metacone.

The brain is smaller than that of *Cynohyænodon cayluxi* although the dentition is one third longer. Compared with that of *Thylacinus* the brain is much smaller in all dimensions, smoother in surface, and with olfactory and cerebellar lobes smaller in proportion, but not in any degree covered by the cerebral lobes.

The limb bones are for the most part a little stouter than those of the domestic cat, not very different in size from those of *S. whitiæ.* They are apparently shorter and stouter in proportion, resembling those of *Viverravus protenus* on a smaller scale. The vertebræ are too poorly preserved for exact comparison.

Measurements, No. 2850.

c^1–m^3..... 70 ; c_1–m_3.... 68 ; m_{1-3}.... 25

Diameters of m^1,	anteroposterior	8, transverse	9
“ m^2	“	9	10.5
“ m^3	“	4	
“ m_2	“	9.5	
m_3	“	9	
Depth of jaw under m_2		19	

Sinopa whitiæ (*Cope*).

Stypolophus strenuus Cope, Bull. Hayd. Sur. No. VI, p. 192.

Stypolophus whitiæ Cope, Proc. Am. Phil. Soc., Vol. XX, 1882, p. 161 ; Tertiary Vertebrata, p. 292, pl. xxvb, figs. 8–14.

Wind River assise, Wyoming. This species is somewhat smaller than *S. hians*, and is distinguished from it by the reduction in size of the last lower molar and the more anteroposterior direction of the trigonid shear. In the upper molars the protocone appears to be more compressed and placed further backward relatively to the outer cusps, and the metacone of m^3 has entirely disappeared. The species is close to *S. agilis* of the Bridger, which has the heels of the lower molars more reduced. It is the best known species of the genus and was fully described and figured by Prof. Cope in 1884.

Nos. 4780 (type), 4781, and 4782.

Measurements.

c^1m^3.... 63 c_1–m_3.... 66 m_{1-3}..... 22.5

Diameters of m^1,	anteroposterior	8, transverse	7
m^2		8	10
m^3		3	9
m_2	?	8.3	
m_3	?	8.3	
Length of heel of m_3		3	
Depth of jaw below m_2		19	

Sinopa strenua (*Cope*).

Prototomus strenuus Cope, Syst. Catal. Eoc. Vert. N. M., Rep. Wheeler Survey, p. 10.

Stypolophus, Final Rep. Wheeler Survey (U. S. G. S. W. 100th Mer.), IV, ii, p. 117, pl. xxxix, fig. 11.

Wasatch assise, New Mexico and Wyoming. Type from New Mexico, in National Museum, Washington. Referred specimens

Nos. 97 and 98, from the Big Horn Valley, Wyoming, Am. Mus. Coll. 1891. All fragments of lower jaws.

It is quite impossible to separate this species from *S. whitiæ* on our present knowledge, but when more complete material is found it will probably show some distinctions. In particular I should expect to find the metaconid present on m^3, as it is on all known Wasatch and no known Wind River species of the genus. I therefore hold the species separate provisionally and refer the Wasatch specimens to *S. strenua.* The characters are: size medium, m_3 smaller than m_2, shear of trigonids 55°–60° from transverse; p^3 with small internal and somewhat larger postero-external cusp; teeth compressed with angulate cusps.

A somewhat smaller variety or distinct species has m_3 less reduced and shear more transverse. It may prove to be *S. multicuspis.* (Am. Mus. Nos. 2815, 4220, 96, and 4218, Wasatch assise, Wyoming.)

Sinopa multicuspis (*Cope*).

Prototomus multicuspis Cope, Syst. Cat. Eoc. Vert. N. M., Rep. Wheeler Survey, 1874 (1875).

Stypolophus, Ext. Vert. N. M., Final Rep. Wheeler Survey, IV, ii, p. 116. Tertiary Vertebrata, p. 290.

Wasatch assise, New Mexico. The type is an upper jaw, separable by the much reduced m^3 (if this tooth be complete). The co-type is a piece of a lower jaw, with which the small specimens referred to above most nearly agree.

[**Sinopa secundaria** (*Cope*).]

Prototomus secundarius Cope, Syst. Cat. Eoc. Vert. N. M., Rep. Wheeler Survey, 1874 (1875), p. 9.

(*Stypolophus*), Ext. Vert. New Mex., Final Rep. Wheeler Survey, IV, ii, 115.

Wasatch assise, New Mexico. All the characters given in the descriptions are common to the genus. The specimen has not been figured. The measurements hardly separate it from *S. multicuspis.*

Sinopa viverrina (*Cope*).

Prototomus viverrinus Cope, Rep. Foss. Vert. N. Mex., Rep. Wheeler Survey, 1874, 13 (125); Syst. Cat. Eoc. Vert. N. M., Rep. Wheeler Survey, 1874 (1875), 9.

(*Stypolophus*), Ext. Vert. New Mex., Final Rep. Wheeler Survey, IV, ii, (1877), p. 112, pl. xxxviii, figs. 1–11; Tertiary Vertebrata, p. 290.

Type of the genus *Prototomus*. Wasatch assise, New Mexico and Wyoming. The small size distinguishes it from any other Wasatch species. Judging from Professor Cope's figures it is also distinguished by the simplicity of p$^{\underline{4}}$, which is little more molariform than p$^{\underline{3}}$ of the larger species. The species appears to be quite primitive in other characters as well, and I am disposed to place with it a few lower jaw fragments in our collections containing molars of appropriate size in which, while the trigonid is high, the metaconid is better developed, the shear more transverse, and the whole tooth wider than is usual in the genus. (Am. Mus. Nos. 94 and ? 2971.)

Sinopa opisthotoma, sp. nov.

Stypolophus sp. innom. OSBORN & WORTMAN, Bull. Am. Mus. Nat. Hist. 1892, 110. "No. 99 is much larger than any described species of *Stypolophus*."

Wasatch assise, Wyoming.

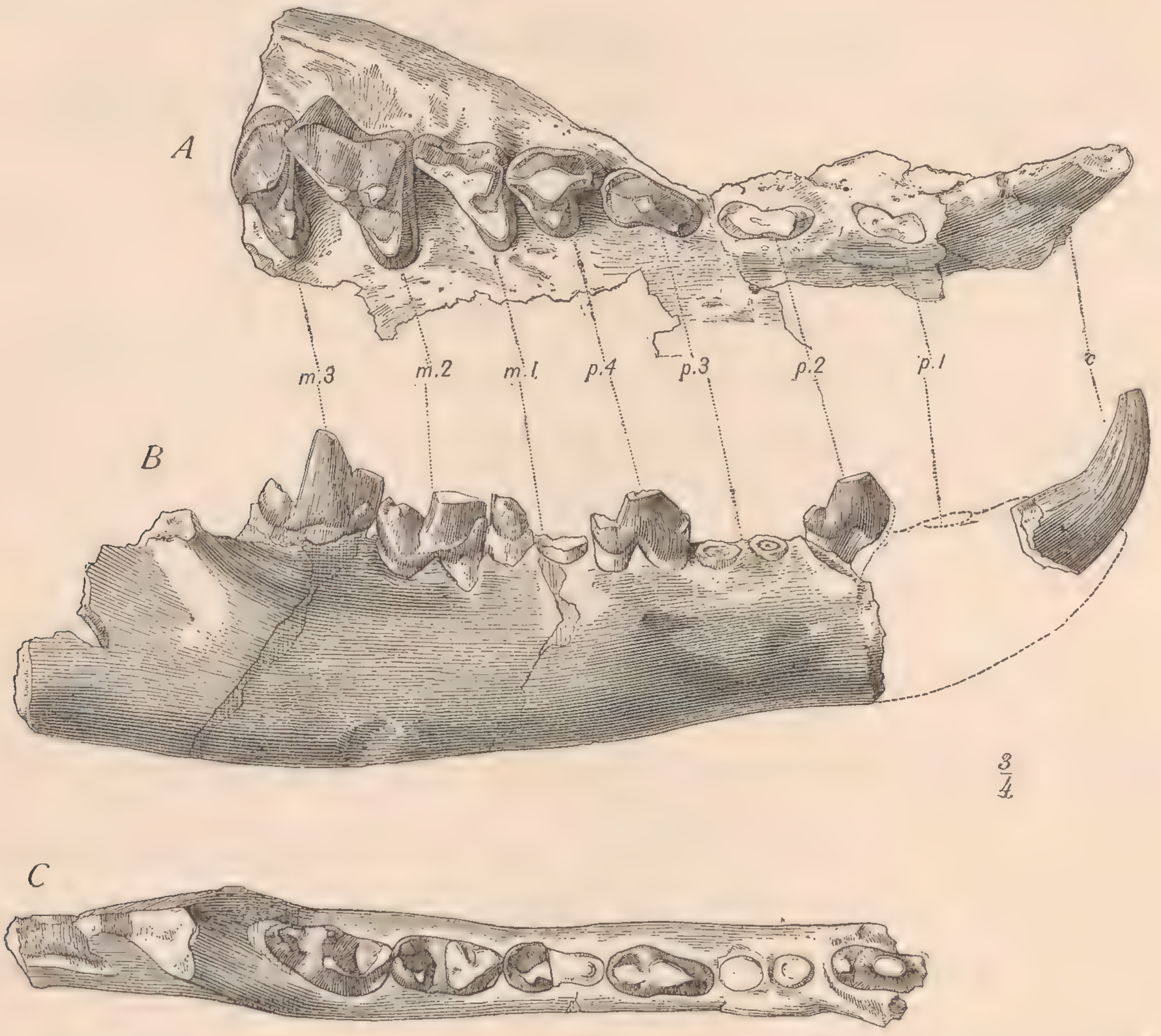


Fig. 9. *Sinopa opisthotoma* Matthew. Upper and lower jaws, three-fourths natural size, type specimen No. 99, Wasatch Beds, Big Horn Basin, Wyoming. Amer. Mus. Exp. 1891. *A*, upper jaw, from below; *B*, lower jaw, from outside; *C*, from above.

With the type (No. 99), upper and lower jaws, teeth well preserved, I associate provisionally No. 101, upper and lower jaw fragments not well preserved, which either is a very large individual of this species or represents a distinct species undescribed.

Anterior premolars spaced; p^3 without distinct accessory cusps; p^4 with main cusp conical-lenticular; internal cusp conical, postero-external cusp not extended into a shearing blade. Outline of m^1 and m^2 obtuse-angled triangles, metastyle especially extended on m^2 *pa.* and *me.* but little connate; m^3 with small metacone, transverse diameter greater than that of m^2. M_2 with well-developed heel; m_3 in type with much reduced metaconid, advanced paraconid forming a shearing blade more nearly anteroposterior than in any other *Sinopa*, and narrow heel. In No. 101 m_3 is normal in character, with more transverse shear and larger heel.

The depth of the jaw is moderate in the type; in No. 101 it is excessive, although the wear of the teeth does not indicate a much older animal. Both have the same rounded cusps, comparatively slight approximation of *pa.* and *me.*, simple p^4, wide m^3, extended blades on m^{1-2} and other characters, so that if distinct the two are evidently closely allied.

Measurements.

		No. 99	No. 101
Length c^1–m^3		83	
" m^{1-3}		26	
" m_{1-3}		31	32
Diameters of p^4,	anteroposterior	10	11
	transverse	10	10
" m^1	anteroposterior	9	? 11
	transverse	10	? 11
" m^2	anteroposterior	12	12
	transverse	13	14
" m^3	anteroposterior	6	6
	transverse	14	14
Length p_{3-4} anteroposterior		18.5	23
" m_1		8	
" m_2		10	10
" m_3		13	13
" heel of m_3		4	6
Width " " "		4	5
Depth of jaw at m_2		19	31

V.—Family MESONYCHIDÆ *Cope.*

Triisodon heilprinianus *Cope.*

Two very incomplete and poorly preserved skulls of this species are of especial interest as the first skulls described from the lower or true Puerco Beds, and hence the *oldest mammal skulls known.*

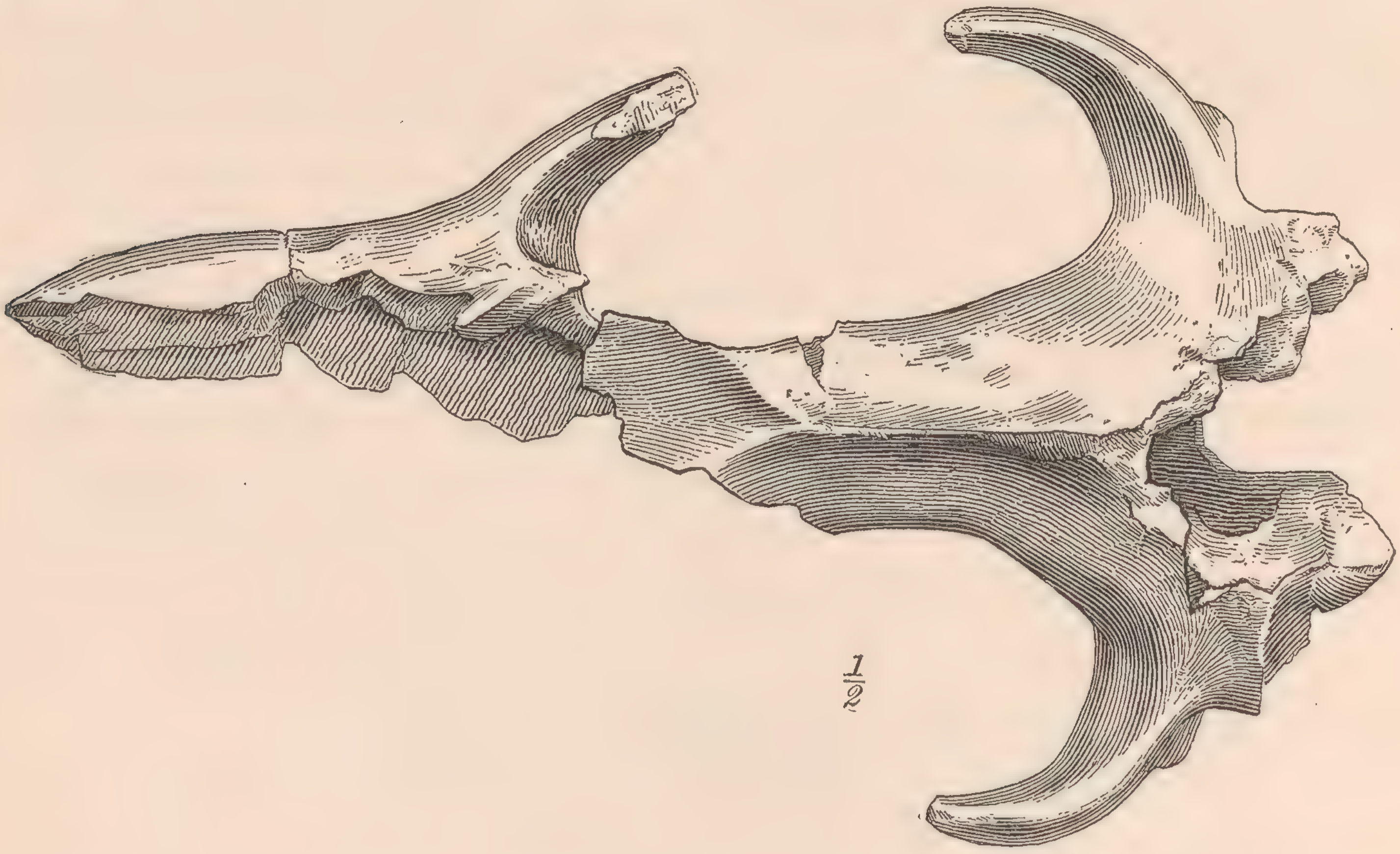


Fig. 10. *Triisodon heilprinianus* Cope. Part of skull, from above, one-half natural size. No. 764, Lower or True Puerco Beds, San Juan Basin, New Mexico. Amer. Mus. Exp. 1892.

The skull compares most nearly with those of *Arctocyon* (Cernaysien), *Mesonyx* (Bridger and Uinta), and *Periptychus* (Torrejon). All have many characters in common :

Brain small, of low type ; zygomatic arches broad ; occipital and sagittal crests very high ; palatal and basicranial axes parallel (*i. e.*, face not at all bent down on basicranial axis) ; mastoid well exposed, tympanic bulla rudimentary or absent ; basisphenoid broad and slightly convex downward ; glenoid fossa deep and long, post-glenoid process moderately developed ; paroccipital process stout not long, confluent with mastoid, projecting laterally rather than downwards ; muzzle thick and heavy, premaxilla with wide ascending process and long contact with nasals. (Nares terminal.)

All the above characters are primitive ones which will probably be found in nearly all Basal Eocene Placentals. The following characters, more or less peculiar to *Triisodon*, I judge to be also primitive.

Zygomatic process of the squamosal moderately stout, as in *Periptychus*, placed well back on the side of the skull (its anterior edge one fourth the skull-length from the occipital condyle) as in *Mesonyx*. In *Arctocyon* it is placed further forward, besides being more massive, reducing the length of the zygomata, which are increased in width though not proportionately.

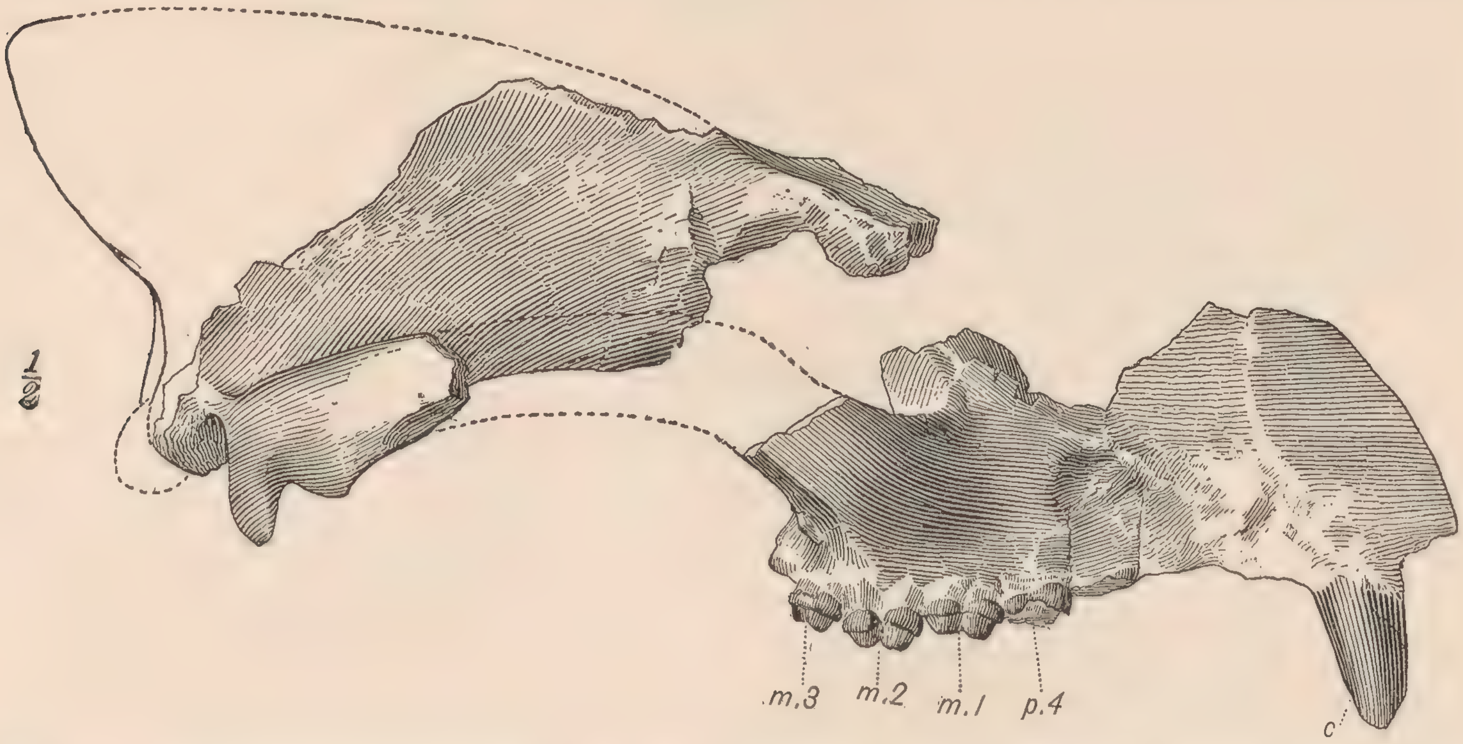


Fig. 11. *Triisodon heilprinianus.* No. 764. Side view of skull, one-half natural size. Outline of occiput from No. 3181.

The postorbital process on the frontal appears to have been less developed than in *Mesonyx;* on the malar it appears to have been absent. The postorbital constriction of the skull is very marked, as much so as in *Arctocyon*, more than in *Mesonyx* or *Periptychus*.

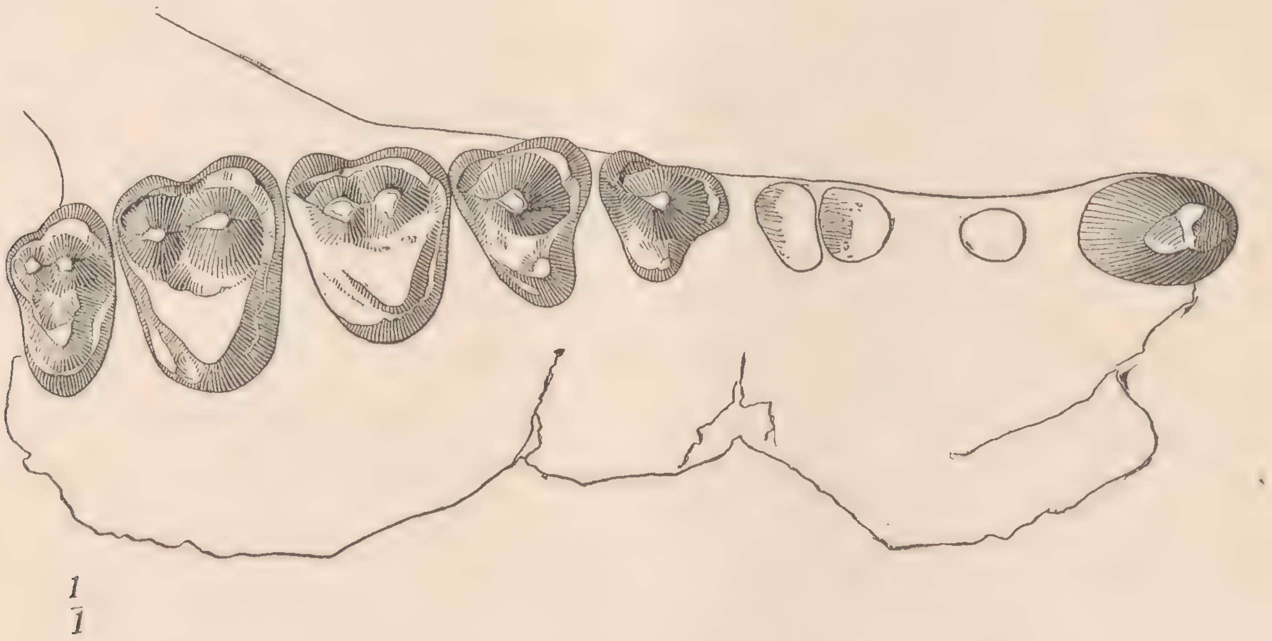


Fig. 12. *Triisodon heilprinianus*, No. 764. Upper dentition, crown view, natural size.

The occipital bones seem to have been firmly sutured together, breaking away rather easily from the rest of the skull.

With the skull were found a few fragments of the skeleton. A *humerus* resembles that of *Arctocyon*, but is smaller and shorter, deltoid crest hardly as prominent, supinator crest somewhat more so, distal trochlea wider but quite as deep. The form of the distal trochlea approximates that of *Pantolambda* and *Periptychus*, but the bone is smaller and slenderer than in either of these, the skulls being of nearly equal size.

Pachyæna gigantea *O. & W.*

"Founded upon a series of finely preserved upper cheek teeth lacking only the first premolar. The specific distinctions from *P. ossifraga* are very marked— (a) the presence of a metacone upon the third upper molar; (b) the more complex structure of the third and fourth premolars; (c) the very broad crenate external cingulum; (d) the relatively smaller size of the metacone in the molars."—*Osborn & Wortman*, 1892, p. 113.

This is one of the largest of the Creodonta, being exceeded in size of skull only by some undescribed specimens of *Mesonyx* in the Museum collections. *Hemipsalodon grandis* Cope, though much larger in skeleton,[1] seems to have had a somewhat smaller skull. Part of a skull and jaws (No. 2823) and a fragmentary skeleton (No. 2959) are here described. Both are from the Wasatch beds of the Big Horn Valley, Wyoming, collected by the Expedition of 1896.

The skull preserves the second premolar and third molar, and alveoli of all the upper teeth except the incisors, also most of one ramus of the lower jaw. The fragmentary skeleton includes parts of the upper jaws with the molars in place, and parts of the lower jaw with the molars in position and the canines and third premolar emerging from the jaw. With it are several loose teeth, most of the limb bones, but all more or less broken, the astragalus and calcaneum and several vertebræ. The epiphyses are missing from the majority of the bones.

Upper Teeth.— First premolar one-rooted, the second and third two-rooted and simple crowned, the fourth three-rooted, molariform, with two well separated cusps of equal size and a widely separated internal cusp. Its peculiar shape, small size, and unusual wear suggest that it is a persistent milk tooth; this view is strengthened by the fact that the corresponding premolar in the lower jaw has dropped out early, its alveolus being closed up. Median (? upper) incisors with large very much compressed root and small crown. Lateral incisor with large root of oval section and small pointed crown. Canine large of round-oval section.

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[1] If the femora referred to it by Professor Cope really belong to the species, which I consider very doubtful, as the proportion of skull and body would be most unusual for a Creodont.

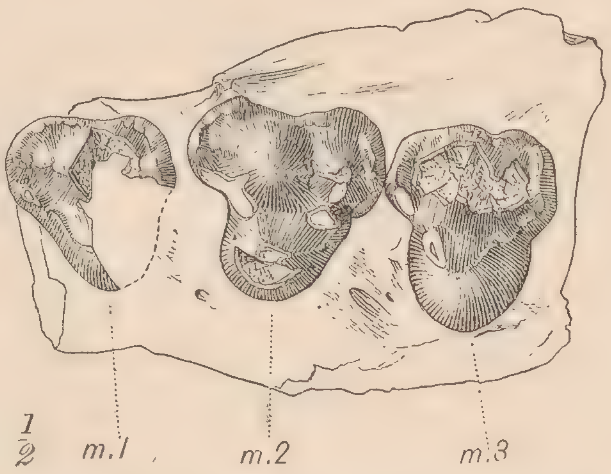

Fig. 13. *Pachyæna gigantea* Osborn & Wortman. Three upper molars in place. Crown view, one-half natural size. Young individual. No. 2959, Wasatch Beds, Big Horn Basin, Wyoming. Amer. Mus. Exped. 1896.

Lower Teeth.— Canines large, moderately stout, regularly oval in section, set near together (interspace about half width of canine). First premolar one-rooted, second two-rooted, third true premolar emerging from the jaw, stout, with protoconid directed strongly backward, wide, square-based, low trenchant heel and no anterior basal cusp. No indication of a fourth permanent premolar could be found in the immature individual, but the state of preservation of the specimen does not make it possible to disprove the existence of one. The temporary premolar is indicated by some remains of an alveolus. In the adult jaw, as already observed, the temporary fourth premolar had fallen out and its alveolus closed without replacement. The first and second molars have a vestigial metaconid ; traces of it are discernible also on the third. All three are shaped like those of *P.*

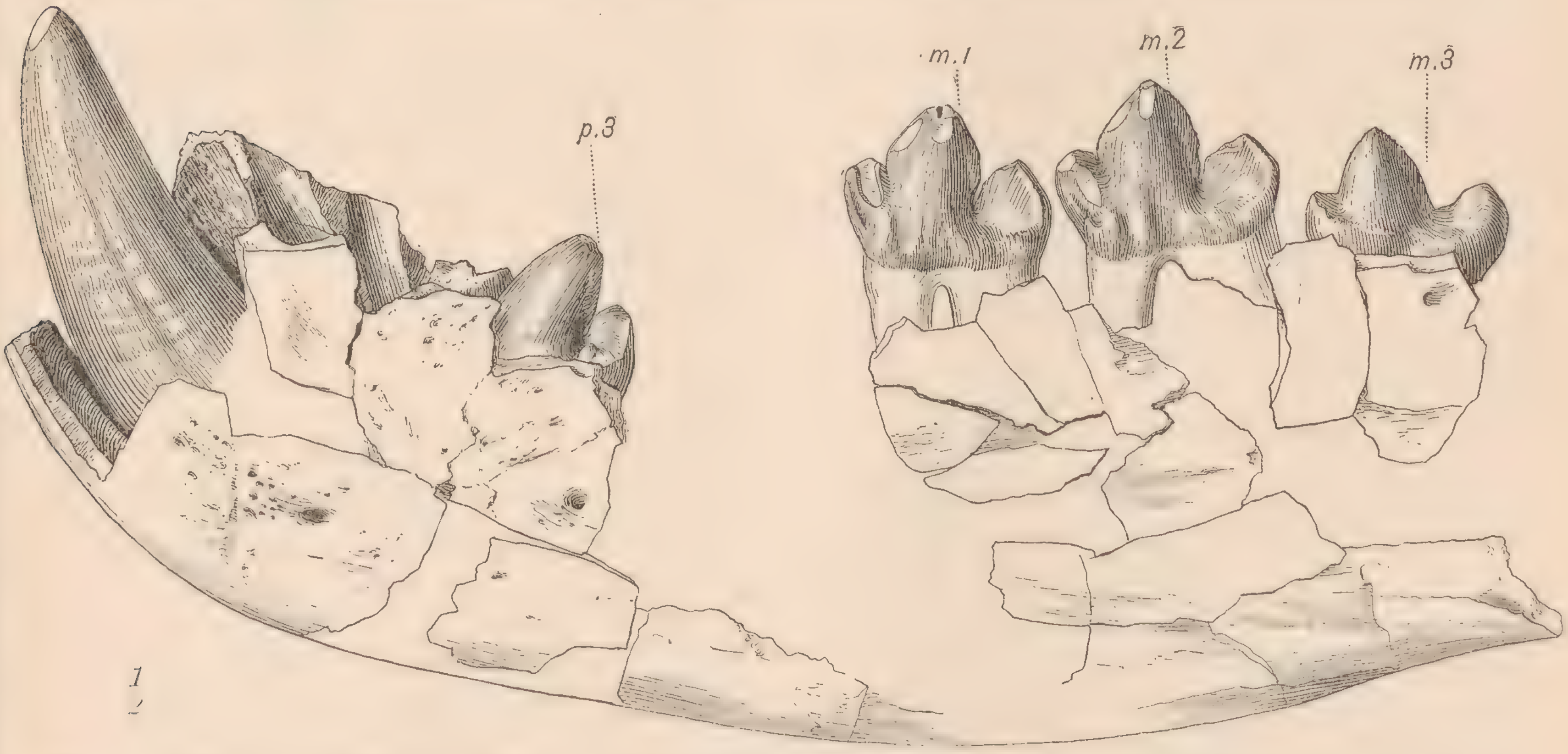

Fig. 14. *Pachyæna gigantea*, No. 2959. Fragmentary lower jaw, external view, one-half natural size.

ossifraga, rectangular in outline when seen from above with high stout protoconid ridged before and behind, large well separated trenchant heel, and smaller less trenchant paraconid. The protoconid is vertical in $m_{\overline{2}}$, projects slightly forward in $m_{\overline{3}}$, and somewhat more backward in $m_{\overline{1}}$. The second molar is the largest and the third the smallest of the three.

The angle of the lower jaw is inflected, more so than in *Dissacus* or *P. ossifraga*, less than in *Mesonyx uintensis*. In *M. obtusidens* "the angle is prolonged into a stout hook much like that of *Stypolophus*" (Scott, '87, p. 157), hence is quite different from the other Mesonychidæ, in which there is a progressively increased inflection of the angle, reaching a maximum in the Upper Eocene *Mesonyx uintensis* where it is almost like that of a Marsupial.

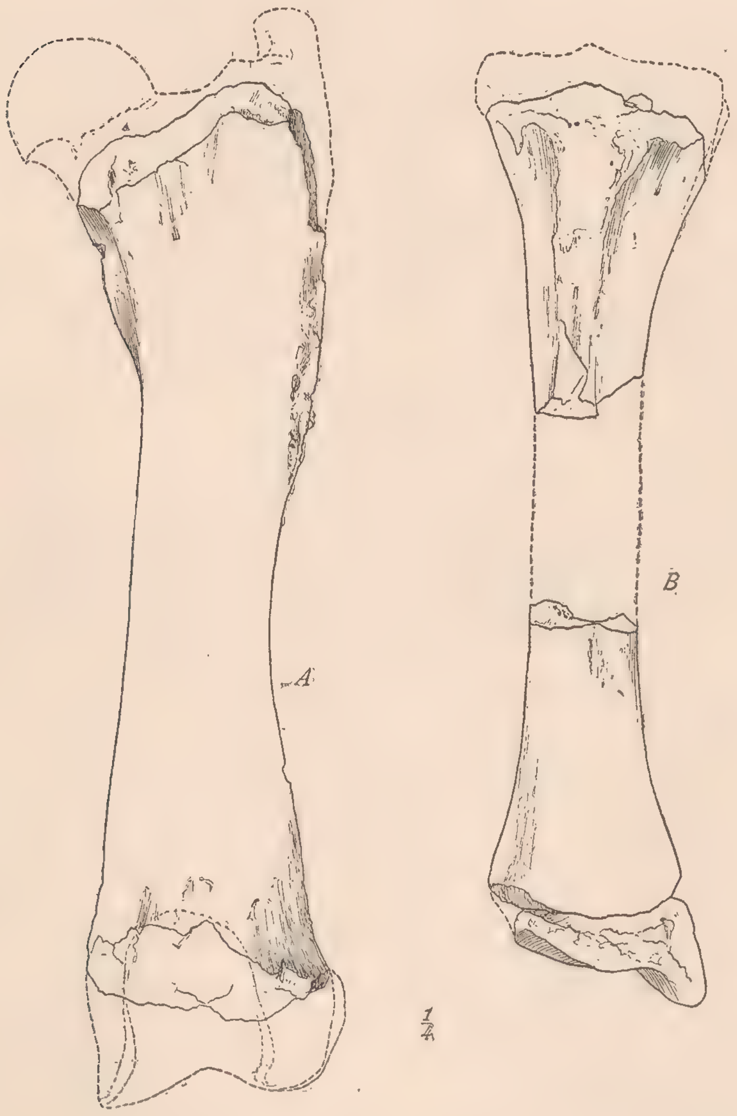

Fig. 15. *Pachyæna gigantea*, No. 2959. Left femur and right tibia, from in front, one-fourth natural size.

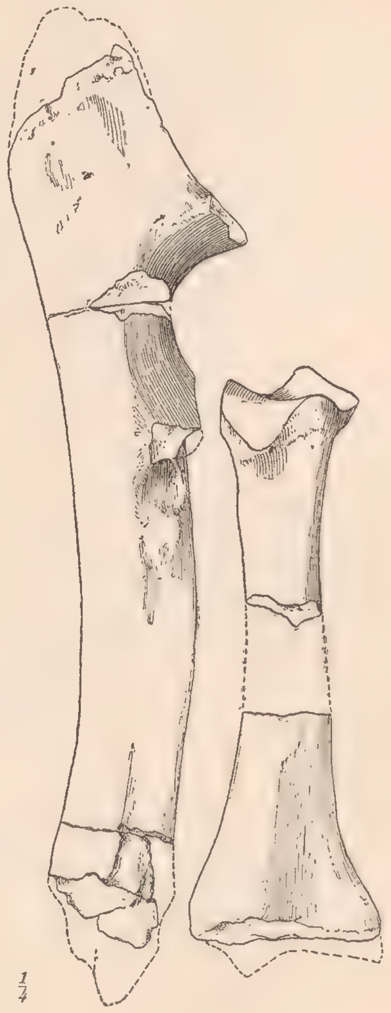

Fig. 16. *Pachyæna gigantea*, No. 2959. Right ulna and radius, one-fourth natural size.

The skeleton is very massively proportioned; the limb bones are somewhat shorter than those of *P. ossifraga*, but one-fourth thicker in the shaft, although the animal is not full grown. The few dorsal vertebræ preserved are short and thick in the centra, and heavy in the arches — apparently short-spined. The calcaneum has a small fibular facet. The astragalus is very short and wide, with flatter trochlea, shorter neck, and smaller sustentacular process than in *P. ossifraga;* it has the distinct cuboidal facet common to the Mesonychidæ, and the navicular facet is flat transversely (slightly concave in *P. ossifraga*, flat in *Dissacus*, convex in *M. obtusidens*).[1]

The most interesting point in regard to this animal is the question of the succession of the teeth. If, as our specimens seem to indicate, the fourth premolar belongs to the milk series, and is not replaced by a permanent tooth, then *this species approximates the marsupial dental formula*, with four true molars and three premolars. The progressive inflection of the angle of the jaw in the Mesonychid phylum is another character of some importance approximating them to the Marsupials. From what we know of the phylum we must regard both these characters as acquired in the Mesonychidæ ; the question then arises — are they not also acquired in the Marsupialia ? This is a matter hardly suitable for discussion within the limits of this paper ; I present the evidence for what it is worth. That there is a progressive inflection of the lower jaw in the Mesonychidæ is certain; the evidence for the retention of the fourth milk molar may be summarized as follows :

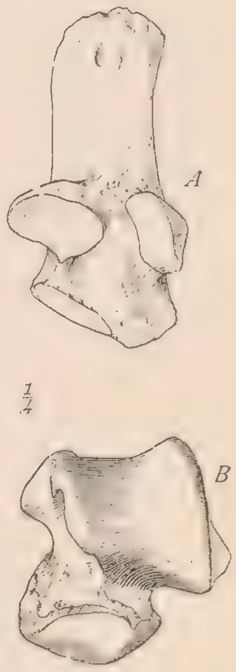

Fig. 17. *Pachyæna gigantea*, No. 2959. Left calcaneum and astragalus, from above, one-fourth natural size.

1. In the upper jaw the last premolar has the ordinary character of a milk molar (small size, short roots, thin enamel, precocious molarization) and is more worn than the first molar or the third premolar, hence probably appeared before either of them.

2. In the lower jaw the fourth premolar has disappeared and its alveolus closed up in an adult specimen, while in a young individual indications exist of an early protruded tooth, but none of a replacing tooth although the third permanent premolar is completely formed and emerging from the jaw.

This evidence cannot be considered satisfactory, especially in view of the fact that in *Triisodon*, the only other Mesonychid in which the replacement of the teeth has been observed, there is a permanent fourth lower premolar, though protruded rather late in life, considerably after $m_{\bar{3}}$ (Cope, '84, 270).

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[1] Professor Scott's statement regarding the last species is that the navicular is concave in both directions. This involves apparently an astragalus convex both ways.

COMPARATIVE MEASUREMENTS

	Pachyæna gigantea			*P. ossifraga*	*Mesonyx obtusidens*	*M. uintensis*
	No. 72	2823	2959			No. 1892
Length of skull........		e. 450		e. 380	279	e. 440
p^{1} m^{3}............	e. 162	163		135	98	137
m^{1-3}	e. 79	78	75	54		
Breadth palate at m^{2}...		135		e. 101	78	121
Depth jaw below $m_{\bar{2}}$...		94	73	68	50	
Length $m_{\bar{1}-\bar{3}}$.........			99	63	51	(88[1])
Humerus, width distal end................			93	62		
Femur, length.........			e. 290	315		
" circumference of shaft........			108	86		
Ulna, length..........			e. 293	286	207	
" circumference of shaft.........			87	65		
Radius, diameter of head			49	34	23	
" circumference of shaft........			67	53		
Tibia, length			e. 265	275	205	
" diameter of distal end..........			58	43	25	
" circumference of shaft.........			87	74		
Calcaneum, length			98	77	56	
" width......			49	41		
Astragalus, length......			61	44	31	
" width.......			58	41	18	
Posterior dorsals, av'ge length of 4 centra ...			34		e. 30	
Posterior dorsals, av'ge width of 4 centra....			58		e. 25	

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[1] From type specimen. 'e.' = estimated from an incomplete specimen.

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Article II.—DESCRIPTIONS OF TWO NEW SPECIES OF SOUTH AMERICAN MURIDÆ.

By J. A. Allen.

For the material on which are based the descriptions of the two species of South American Muridæ here described I am indebted to the kindness of Mr. Oldfield Thomas, Curator of Mammals in the British Museum, who in referring the specimens to me for determination kindly gave me permission to publish any species that proved to be new. He has also permitted me to retain some of the duplicates for this Museum, the types being very properly returned to the British Museum.

Zygodontomys thomasi,[1] sp. nov.

Type, ♀ ad., Campo Alegre, Venezuela, 90 miles south of Cumana (alt. 1625 feet), May 4, 1899. Collector's No. 416. Type in British Museum.

Color above pale yellowish brown, clearest or most pronounced on the lower back and rump, and slightly darkened with black-tipped hairs, especially over the middle of the dorsal region; paler and grayer on the sides; sides of muzzle pale yellowish; below whitish gray, the hairs being plumbeous broadly tipped with soiled white; ears rather large, pale brown, clothed with fine short hairs; upper surface of both fore and hind feet pale buffy white, soles light brown, palms flesh-color; tail short, dark brown above, much lighter, grayish brown beneath.

Measurements[2].—Type, head and body, 125 mm.; tail, 99; hind foot, 23; ear, 18. Another specimen, ♂ ad., from Quebara Secca: Head and body, 116; tail, 101; hind foot, 26; ear, 17. Another ♂, young adult, from Campo Alegre: Head and body, 113; tail, 100; hind foot, 25; ear, 17.

Skull (type), occipital portion lacking, gives the following: Nasals to posterior border of parietals, 27; nasals, 12; palatal length, 13.3; zygomatic breadth, 16; interorbital breadth, 5; palatine foramina, 6.2 x 2.2; upper molar series, 4.

This species is based on three specimens, collected at Campo Alegre, Cumana, Venezuela, at altitudes varying from 1350 to 1625 feet, Feb. 2 and 7, and May 4, 1899, sent to me for examination by Mr. Oldfield Thomas, and on an additional specimen (Am. Mus. No. 14731, ♂ ad.), from a neighboring locality. In general form and proportions it resembles *Z. brevicauda* (All. &

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[1] Named for Mr. Oldfield Thomas, to whom I am indebted for valued assistance.
[2] Collector's measurements, from the fresh specimen.

Chapm.) from the Island of Trinidad, but it differs from it in being fully one third smaller and very much paler in coloration.

Sigmodon simonsi, sp. nov.

Type, ♂ ad., Eten, coast region of northwestern Peru (alt.) 10 to 15 m., Sept. 6, 1899; coll. P. O. Simons. Collector's No. 552. Type in British Museum.

Above pale buffy gray varied with black-tipped hairs; sides of head below eyes, and a well defined eyering, clear buff; nose and sides of muzzle pale ochraceous buff; whole underparts pale buff; ears finely haired, colored externally like the surrounding pelage, buff internally; upper surface of fore and hind feet pale buff, the hind feet a little darker than the fore feet; tail well covered with short stiff hairs, dusky brown above, lighter and more buffy brown below.

Measurements.[1]—Type, head and body, 155 mm.; tail, 100; hind foot, 29; ear, 23. Five adult specimens (4 males, 1 female) measure: Head and body, 151 (134–164); tail, 98 (93–100); hind foot, 30 (29–31); ear, 21 (20–23).

Skull.—Posterior border of palate thickened and depressed; rostral portion of skull convex, the nasals markedly decurved anteriorly; skull in general broad and heavily ossified. Dentition very heavy. Total length, 35.7; basal length, 23.5; palate, 16; nasals, 12.4; zygomatic breadth, 20.3; mastoid breadth, 14.7; interorbital breadth, 6; palatine foramina, 7 x 2; upper molar series, 7.

This species is based on a series of five specimens collected at Eten, coast region of northwestern Peru, in September and October, 1899, by Mr. P. O. Simons, after whom the species is named. They are all practically adult, and all males except one.

Sigmodon simonsi is very distinct from any previously described species of the genus from South America. In the pale coloration of the dorsal surface it most nearly resembles *S. hispidus texianus*, and in the buffy ventral surface recalls *S. minimus* Mearns from Arizona, and *S. fulviventer* Allen from western Mexico. Its nearest geographical representative is *S. peruanus* Allen, from which it differs in the much broader and heavier skull of the latter, and also very strongly in coloration. *S. simonsi* is obviously a pale, desert type, while *S. peruanus* is as deeply colored as *S. bogotensis* or *S. sanctæ-martæ*. *S. peruanus* is very unlike the two last-named species, however, in cranial characters. *S. bogotensis* and *S. sanctæ-martæ*, it may be added, prove to be very closely related *inter se*.

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[1] By the collector, from fresh specimens.

Article III.—ON A FURTHER COLLECTION OF MAMMALS FROM SOUTHEASTERN PERU, COLLECTED BY MR. H. H. KEAYS, WITH DESCRIPTIONS OF NEW SPECIES.[1]

By J. A. Allen.

The Museum has just received a third collection of mammals made by Mr. H. H. Keays, at the Inca Mines, near Juliaca, southeastern Peru. This collection contains nearly all of the species previously received from Mr. Keays, and eight additional, three of which appear to be undescribed. The species additional to the former list are nearly all from other localities, as San Antonio, Osila, and Tirapata, situated at much higher altitudes than the Inca Mines.

In this connection it is necessary to correct a misleading statement in my former paper in respect to the locality where the principal part of Mr. Keays's first collections were made. Mr. Keays's post-office address was Juliaca, and through lack of explicit information, it was inferred that the Inca Mines, where he collected, were in the immediate vicinity of Juliaca. In a later letter Mr. Keays informs me that the Inca Mines are situated about 200 miles northeast of Juliaca, on the east side of the Andes, on the Inambary River, a tributary of the Amazon, and at a much lower altitude than Juliaca. The altitude and geographical position were correctly given in the former paper, but in place of Juliaca, in the introduction and for the type localities, read Inca Mines. San Antonio and Tirapata have an altitude of 12,000 to 16,000 feet.

The species not recorded in the former list are indicated by a star prefixed to the number. All the external measurements given are the collector's measurements from the fresh specimens, except when otherwise stated.

1. **Didelphis pernigra** *Allen.*—A series of 5 adults—3 males and 2 females—collected at the Inca Mines, June 5–July 22, 1900, are exceedingly uniform in coloration, and agree perfectly

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[1] For a report on the former collections see this Bulletin, Vol. XIII, 1900, pp. 219–227 published Nov. 16, 1900.

with the type and other specimens already described (this Bulletin, XIII, pp. 191 and 219). The small size of this species, for a member of the genus *Didelphis*, its intensely black pelage, wholly white ears, and prominent black eye-stripe serve at once to distinguish *D. pernigra* from any of its congeners.

2. **Thylamys keaysi** *Allen.*—Two specimens, ♂ and ♀ adult, Inca Mines, May 31 and July 2.

3. **Lagidium peruanum** *Meyen.*—One specimen, ♀ adult, Tirapata, Oct. 18, 1900. Mammæ 2, pectoral. Since sending his former field notes on this species (*l. c.*, p. 220), Mr. Keays has found it to inhabit "a part of the east slope of the Andes, where he found them quite common from 12,000 feet to 16,000 feet altitude." The female here recorded, he says, "contained one young; her teats, two in number, were large and situated on the upper breast."

4. **Dactylomys peruanus** *Allen.*—One specimen, male, Inca Mines, June 3, 1900. Although apparently fully adult, the last molar being fully grown and already somewhat worn, it is smaller than the female type (*l. c.*, p. 220).

This specimen is throughout a little brighter and richer colored than the type, and is doubtless in fresher pelage. The collector's measurements are as follows: Total length, 483 mm. as against 560 in the female; head and body, 228 (♀, 240); tail, 255 (♀, 320); hind foot, 44 (♀, 51). These measurements confirm the small size ascribed to this species in comparison with its congeners.

5. **Proechimys simonsi** *Thomas.*—The five additional specimens include 3 adult males, 1 adult female, and 1 half-grown female, all from Inca Mines. The young example is white below, like the adults, but uniform blackish above, with coarse sub-spiny hairs over the middle of the back. The adults are very uniform in coloration, with the median dorsal area distinctly blackish.

6. **Nectomys garleppii** *Thomas.*—Represented by a single half-grown female, dusky brown above with an olivaceous tinge, passing to yellowish olivaceous on the sides. Below buffy, as in the adults, but the buff is of a more olivaceous shade.

7. **Neacomys spinosus** (*Thomas*).—This interesting species is represented by 18 additional specimens, all adult, and all from Inca Mines. They vary greatly in color, in some specimens black

being the prevailing tint above, while others are uniform yellowish rufous above, with every intermediate stage.

8. **Oxymycterus juliacæ** *Allen.*—A second specimen, an adult male, closely resembles the type (*l. c.*, p. 223) from which only the species was previously known. Both were collected at Inca Mines.

9. **Oxymycterus apicalis** *Allen.*—An additional series of 9 specimens, all adult except one, which is only about one third grown. This is grayer below and less gray above than adults. In other respects the specimens are like those previously recorded. The white tip to the tail is a prominent feature in all.

10. **Oryzomys keaysi** *Allen.*—Five specimens, all adult, and like those previously described (*l. c.*, p. 225), and from the same locality.

11. **Oryzomys obtusirostris** *Allen.*—One specimen, adult male, Inca Mines, June 16. The faint yellowish wash on the upper parts is rather more pronounced than in the type, and the general coloration above is consequently less blackish than is indicated in the description of the species (*l. c.*, p. 225).

* 12. **Oryzomys stolzmanni** *Thomas.*—One specimen, an adult female, Inca Mines, May 5, 1900.

* 13. Rhipidomys ochrogaster, sp. nov.

Type, No. 16481, ♀ ad., Inca Mines, Peru (alt. 6000 feet), Sept. 14, 1900; coll. H. H. Keays.

Above dull yellowish brown, minutely varied with black-tipped hairs, paler and more yellowish on the sides; a slight dusky eyering; beneath pale ochraceous buff, the hairs at the extreme base pale gray; ears blackish brown, well haired externally, nearly naked within; upper surface of feet, including toes, dusky grayish brown, with longer whitish hairs at the base of the claws; tail uniform blackish, the proximal half scantily haired, the hairiness increasing apically, in some specimens wholly concealing the annulations, with a long bushy pencil at the end, the hairs extending as a heavy tuft 20 mm. beyond the vertebræ. Mammæ, 6,—4 inguinal, 2 pectoral.

Measurements.—Type, total length, 382 mm.; head and body, 154; tail to end of vertebræ, 228; hind foot, 35; ear (in dry skin) from notch, 19. Another specimen, also a female, measures, total length, 405; head and body, 164; tail, 241; hind foot, 38.

Skull (of type), total length, 37; basal length, 31; palatal length, 15; nasals, 14; zygomatic breadth, 19.5; interorbital breadth, 6; mastoid breadth, 10; palatal foramina, 8 x 3; upper tooth-row, 6.

This species is based on two females, both adult, but one a little older and a little larger than the other. The smaller has been taken as the type, owing to the poor condition of the skull of the other. The specimens were collected at Inca Mines, Sept. 14 and Oct. 9, 1900.

Rhipidomys ochrogaster is one of the largest species of the genus, exceeded in size apparently by only *R. couesi* (All. & Chapm.) from Trinidad. All of the other buff-bellied members of the group are very much smaller, and otherwise obviously different. It differs from *Hesperomys* (*Rhipidomys*) *leucodactylus* Tschudi, the only other described Peruvian species, in being more than one third larger, and in its ochraceous instead of whitish ("subtus albescens") underparts.

*14. **Phyllotis boliviensis** (*Waterhouse*).—Ten specimens, all adult, five of which are from San Antonio, collected Oct. 16, and five from Tirapata. The species was not met with at Inca Mines.

This species appears to be in part diurnal, as long since observed by Bridges (Ann. and Mag. Nat. Hist., XVII, 1846, p. 483). Mr. Keays obtained most of his specimens by shooting them while they were feeding on the grass, early in the morning and late in the evening.

The collector's measurements of these 10 specimens may be summarized as follows: Total length, 185 (177–216); head and body, 104 (95–114); tail, 82 (76–102); hind foot, 24 (23–25).

*15. **Phyllotis osilæ**, sp. nov.

Type, No. 16503, ♀ ad., Osila, Peru (alt. about 12,000 feet), Oct. 19, 1900; coll. H. H. Keays.

Above fulvous gray, slightly darkened with black-tipped hairs, especially along the middle of the back; cheeks and sides pale dull fulvous (about 'cream buff' of Ridgway), sharply separated from the white of the ventral surface; sides of nose grayish white; lower parts white, the hairs plumbeous for the basal two thirds; pectoral region and median line posteriorly (for a short distance), and also a small area at base of tail, faintly tinged with buff; ears large, blackish-brown on both surfaces, nearly naked externally, clothed within with short fine dusky hairs; upper surface of hands yellowish white, of feet clear white; tail very long, slightly penicillate, dusky on the median line above, sides and below white, the lower surface thickly covered with soft silky white hairs, the upper surface sparingly clothed with dusky hairs, through which the annulations are plainly visible.

Measurements.—Type, total length, 232 mm.; head and body, 99; tail, 133;

hind foot, 25 ; ear (in dry skin), 24.5. A second specimen, 'young adult' female, is somewhat smaller, as follows : Total length, 191 ; head and body, 70, tail, 121.

Skull.—Similar in general features to that of *P. boliviensis*, but the interorbital and rostral portion slenderer and relatively longer, and the bullæ relatively smaller ; whole skull much smaller and more lightly constructed. Total length, 28 ; basal length, 22 ; palate, 12 ; nasals, 11.5 ; zygomatic breadth, 15 ; interorbital breadth, 4 ; mastoid breadth, 12.5 ; palatal foramina, 6 x 2 ; upper tooth-row, 5.7.

This species is based on two specimens, an adult female and a young adult female, the latter taken at Tirapata, Oct. 20, and the former at Osila, between San Antonio and Tirapata, Oct. 20. The collector states in his notes that they were taken at the same localities with *P. boliviensis*, and that they had the same habits. One was taken in a trap and the other shot while feeding late in the afternoon.

In size and proportions *P. osilæ* resembles the *P. amicus* group, especially *P. amicus montanus* Thomas, from Urumarca, northern Peru, from which it differs in being larger, with a longer tail, darker coloration, and dusky brown ears.

16. **Akodon caliginosus** (*Tomes*).—Represented by 19 specimens, 15 of which are adult and 4 young. All are from Inca Mines. The young examples include one about one half grown, one about one third grown, and one nursling. In coloration they scarcely differ from the darker adults. The olivaceous tint above in the adults varies somewhat in different specimens, being darker or lighter according to the extent of the yellowish rufous tipping the hairs.

* 17. **Akodon pulcherrimus** *Thomas.*—Five specimens, of which one is from Tirapata, and two each from Limbana and Crucero.

The collector's measurements of these specimens are as follows : Total length, 167 (162–176) ; head and body, 92 (89–96) ; tail, 76.5 (68–82) ; hind foot, 24 (22–25).

Mr. Thomas's description fails to mention the very prominent deep rusty fulvous spot on each side of the nose, but it otherwise exactly fits the present examples, except that his type considerably exceeds in size any of the specimens in this series. These specimens are, however, from near the type locality and are not likely to prove different from those described by Mr. Thomas.

* 18. **Akodon lutesens**, sp. nov.

Type, No. 16507, ♀ ad., Tirapata, Peru (alt. about 15,000 feet), Oct. 21, 1900; coll. H. H. Keays.

Pelage very soft and full. Above fulvous gray brown, mixed very slightly with dusky-tipped hairs; sides dull pale fulvous gray, passing gradually into the pale buffy gray of the whole lower surface; no distinct eyering; sides of muzzle and cheeks like rest of the head; ears very small, well haired, nearly concealed by the surrounding pelage, of the same pale fulvous gray tone as the rest of the dorsal surface; upper surface of hands dull dusky gray with a faint tint of fulvous; upper surface of feet dull yellowish gray; tail considerably shorter than head and body, scantily haired, with a faint median dusky line above, pale yellowish gray on sides, lighter, soiled gray below.

Measurements.—Total length (type), 140 mm.; head and body, 76; tail, 64; tarsus, 19; ear (in dry skin) 8.5. A second specimen; a young adult, has the same coloration and proportions, but is smaller (head and body, 70; tail, 57).

Skull.—The skull of the type is unfortunately much broken, but that of the topotype, though smaller, is perfect. The skulls seem to offer no special cranial distinctions. Total length, type, 24; basal length, —; zygomatic breadth (approximate), 12; interorbital breadth, 4; mastoid breadth, 10.5; upper tooth-row, 4.

This small, soft-haired, dull-colored species is based on two specimens, an adult female and a young adult male, taken at Tirapata, Oct. 21. The collector states they were "shot at 8 A.M. while feeding on the bark of a small sage shrub."

Akodon lutescens appears to resemble in a general way several other species of the soft-haired, dull-colored section of the genus, but agrees with none of the described species in respect to details of size, coloration, and proportions. It agrees quite nearly in size with *A. pusillus* (Philippi) from Valparaiso, Chili, but differs from it in the color of its ears, feet, and underparts. It differs much more widely from any of the other described species.

19. **Sciurus æstuans cucinus** *Thomas.*—Three specimens, all adult females, from the vicinity of the Inca Mines.

* 20. **Myotis**, sp.—Two specimens, representing a third species of this genus from Inca Mines (*l. c.*, p. 227), none of which is as yet satisfactorily determined.

* 21. **Lasiurus varius** (*Poeppig*).—One specimen, adult male, Inca Mines, June 16, 1900. "Taken from a woodpecker hole in a dead stub."—H. H. K.

Article IV.—NOTICE OF A NEW SPONGE FROM BERMUDA AND OF SOME OTHER FORMS FROM THE BAHAMAS.

By R. P. Whitfield.

With Plates I–V.

Siphonochalina stolonifera *Whitf.*, sp. nov.

Plates I, II, and III.

Among a large number of sponges obtained from Bermuda, there is one of a very peculiar character related to the monactinal tube sponge, *Siphonochalina papyracea* Schum., as labeled by Prof. A. E. Verrill in the Museum collection, which is somewhat common in the Bermuda waters, but it presents an entirely different habit of growth from that and differs materially in structure, texture, and color from any of the many specimens of that species obtained or examined. That species is usually grayish or yellowish gray in color, or variously tinted with yellow or bluish white, while this, when living and obtained, was of a pale yellow-pink tint. It was very delicate and was growing pendent on the side of the submerged cliff among the sea-weeds and other forms of marine life, while *S. papyracea* is found almost exclusively on the bottom, or if it is on the top or sides of the reefs it is rigid and erect.

The specimen described consists of a number of tubes growing erect or laterally from an attachment on the rock. These throw out innumerable ramifications in the form of stolons, or root-like bifurcations, which divide and afterwards anchylose with the tubes or with each other, wherever they touch or come in contact while living. The tubes are smaller than those of *S. papyracea*, smooth exteriorly, of fine texture, and are coronated at the top by a circle of tooth-like projections in a single or double row. These projections are 5 or 6 mm. or more in length and number from fifteen to thirty or more on the largest tubes. The root-like ramifications, except the larger ones, are not tubular or are only partly so, but they have a dense or semisolid axis extending to the extreme point. This axis and the axis of the tooth-like points forming the corona of the main tubes and the rib-like ridges which serve to strengthen and give rigidity to the tubes, and which are the axes of previous coronal teeth, are all composed of bundles of a denser part of the skeleton fibers of the sponge. These are filled with a greater number of spicules than are the fibers of the outer or more delicate portion of the skeleton and are readily seen through its substance as dark lines.

The general surface of the sponge skeleton is of very fine, rather smooth texture throughout, much more so than that of *S. papyracea*, and in color it is a very pale horn-color, fading to a very light gray.

The spicules are very slender, cylindrical, very slightly curved, and very sparingly distributed along the fibers throughout the outer portion of the skeleton. They become more densely arranged toward the axial portions of the root-like stolons and in the ribs and tooth-like projections of the tubes and of the coronas, as well as in the few spine-like processes on the main tubes, where such exist. In these parts the skeleton fibers are sometimes almost entirely filled with spicules to the number of six or eight and perhaps more, side by side along the axis. The spicules have a length of from four to seven and a half hundredths of a millimeter, the diameter being about .005 mm.

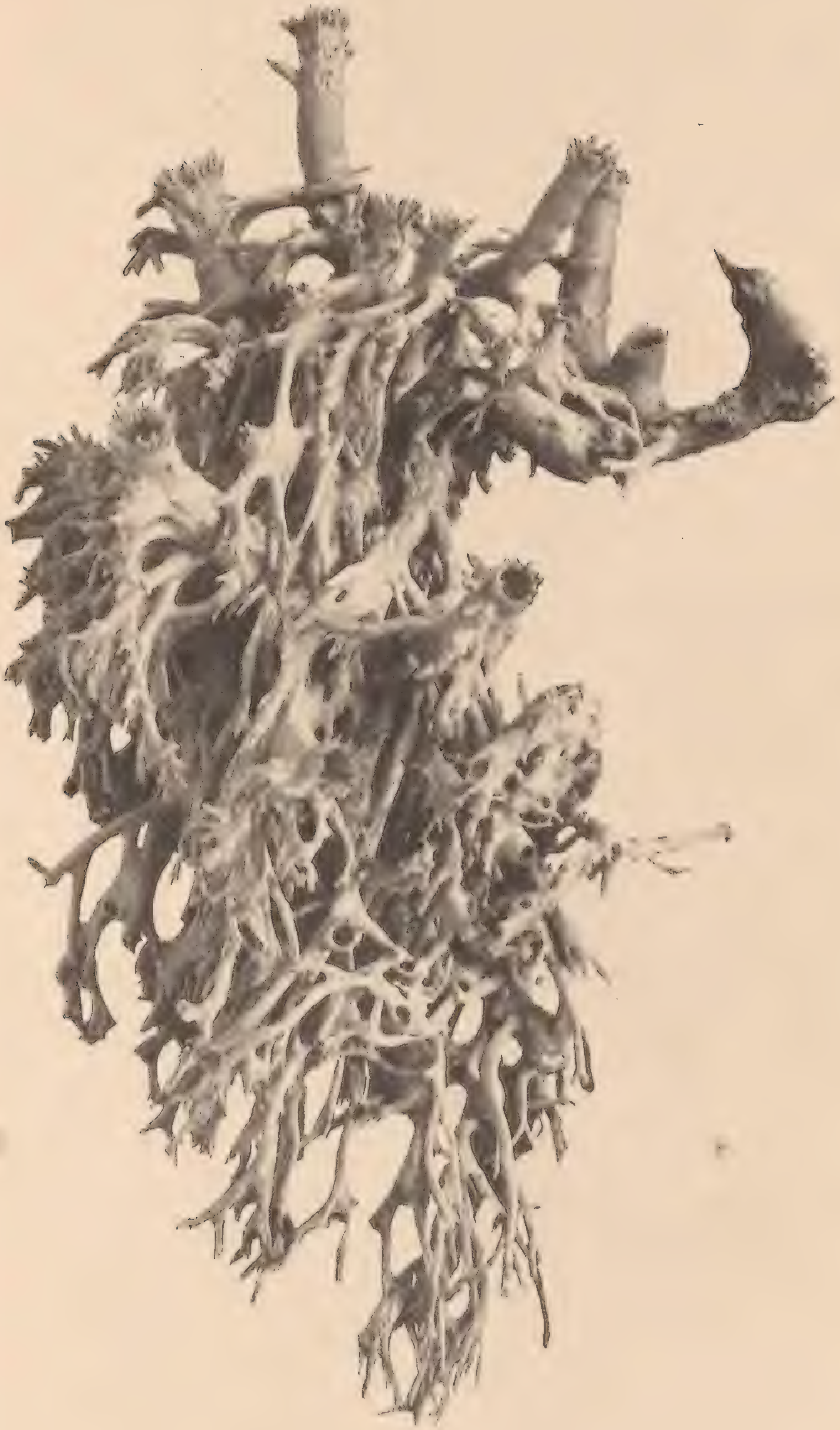
The spicules of *Siphonochalina papyracea* have the same general form and are of about the same size as those of this species, but are differently distributed, and in the axes of the spines they are not arranged in such numbers. The fibers of the skeleton, furthermore, are grouped in knots entirely different from those of the new species and the spicules become crowded only in the knots formed at the junction of several branching fibers of the skeleton.

Among the sponges obtained from the waters around Nassau there are several that cannot be placed under any of the species known, and a number of them probably deserve to be ranked as new species. There are two, however, that deserve particular notice and which might be placed as varieties under *Hircinia acuta* Hyatt, but I think that they fully deserve to rank as distinct species.

EXPLANATION OF PLATE I.

Siphonochalina stolonifera Whitf., page 47.

Lateral view of the sponge skeleton, one-third natural size.



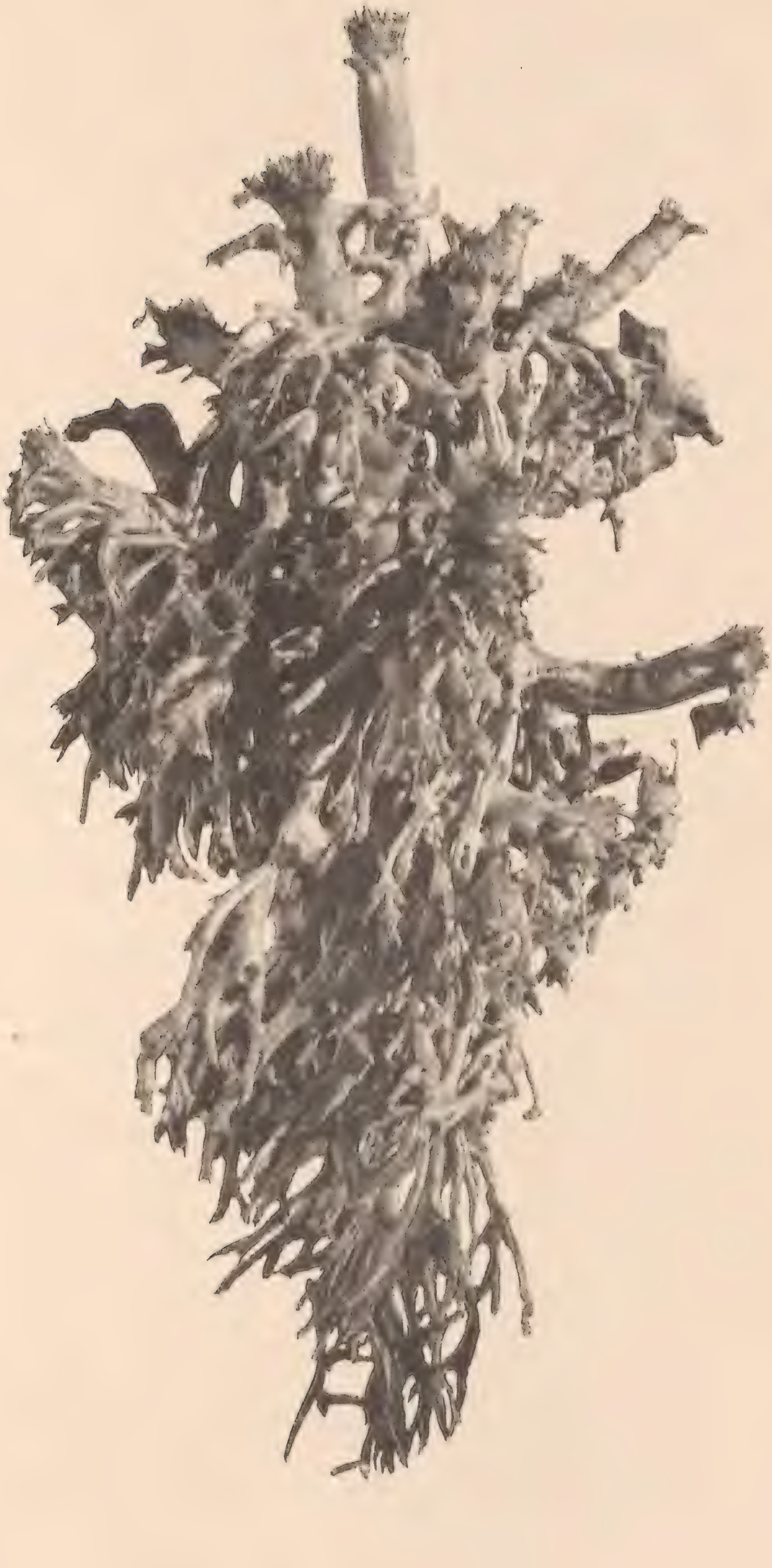
NEW SPONGE.

THE HELIOTYPE PRINTING CO., BOSTON.

EXPLANATION OF PLATE II.

Siphonochalina stolonifera Whitf., page 47.

Front view of the sponge skeleton, one-third natural size.



New Sponge.

THE HELIOTYPE PRINTING CO., BOSTON.

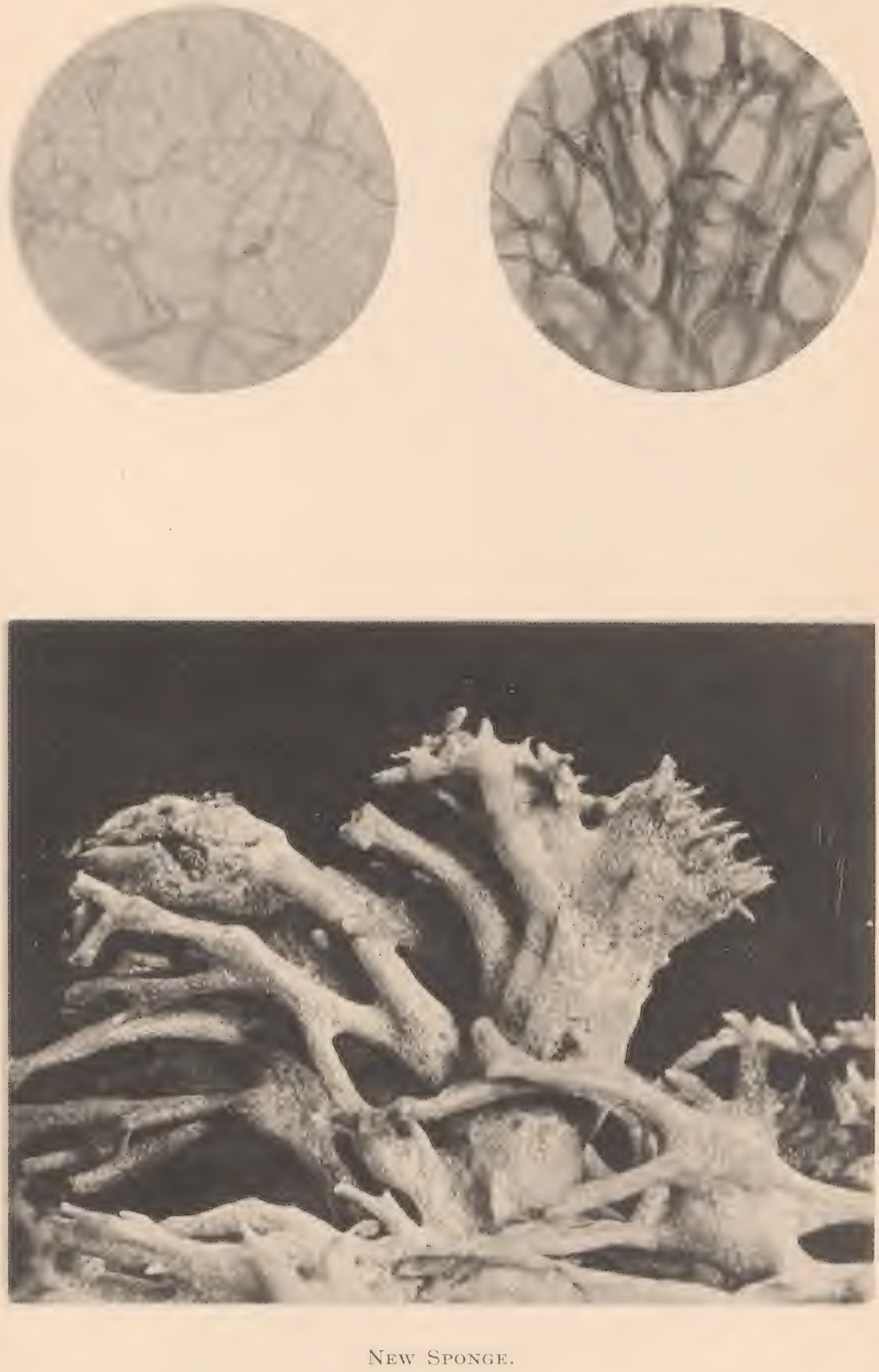
EXPLANATION OF PLATE III.

Siphonochalina stolonifera Whitf., page 47.

Fig. 1. View, natural size, of the largest coronated tube, showing the stolons, or root-like appendages, with their frequent ramifications and blendings, one with another.

Fig. 2. Enlargement to 52 diameters of a fragment of the skeleton from the surface of one of the root-like branches.

Fig. 3. Enlargement to 52 diameters of the skeleton axis of an appendage showing the arrangement of the spicules as they appear in all the axes and spines of the tubes and coronas.

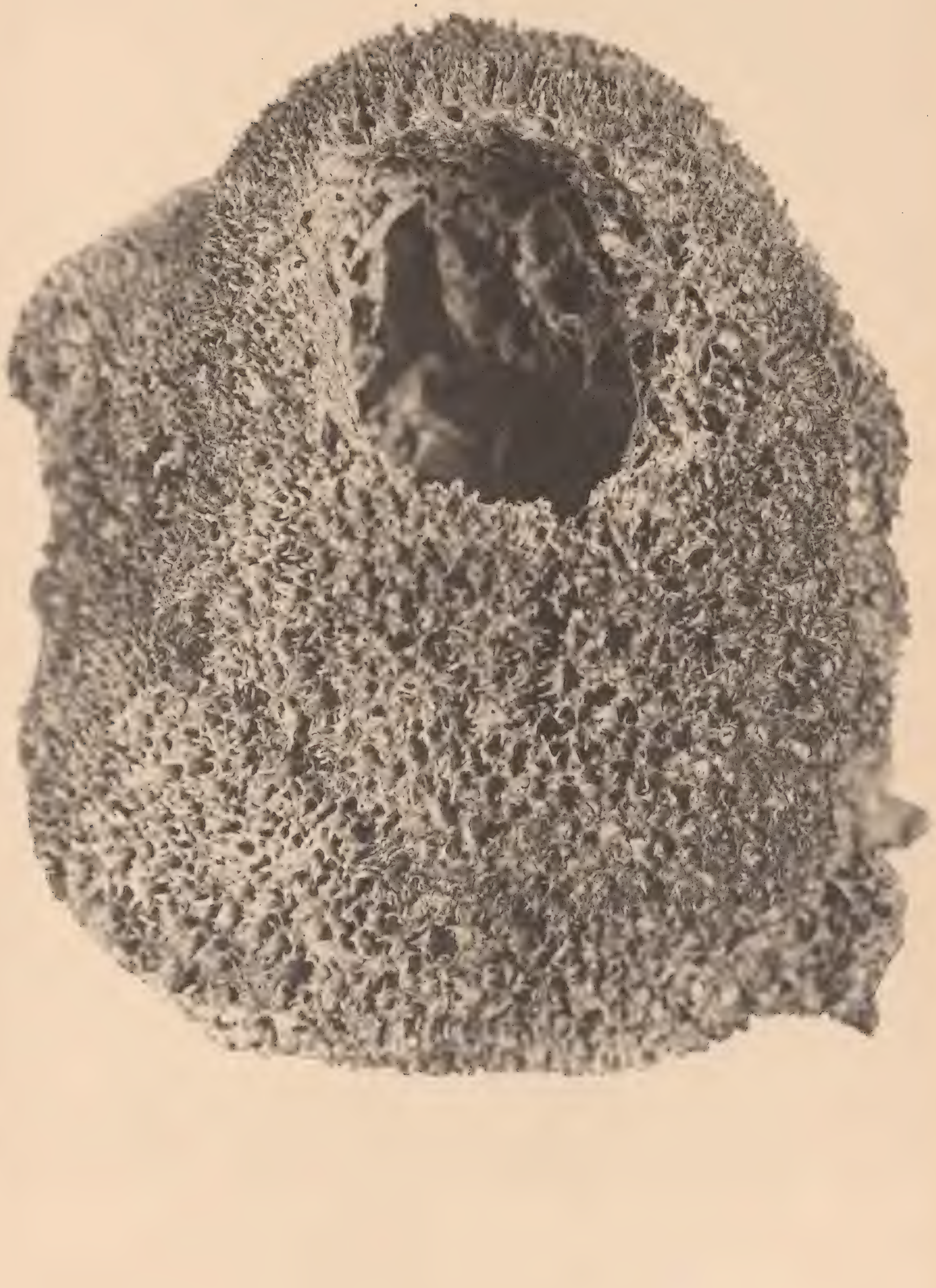


New Sponge.

EXPLANATION OF PLATE IV.

Hircinia purpurea Whitf., page 49.

View of the upper front side of the type specimen reduced to four-fifths natural size.



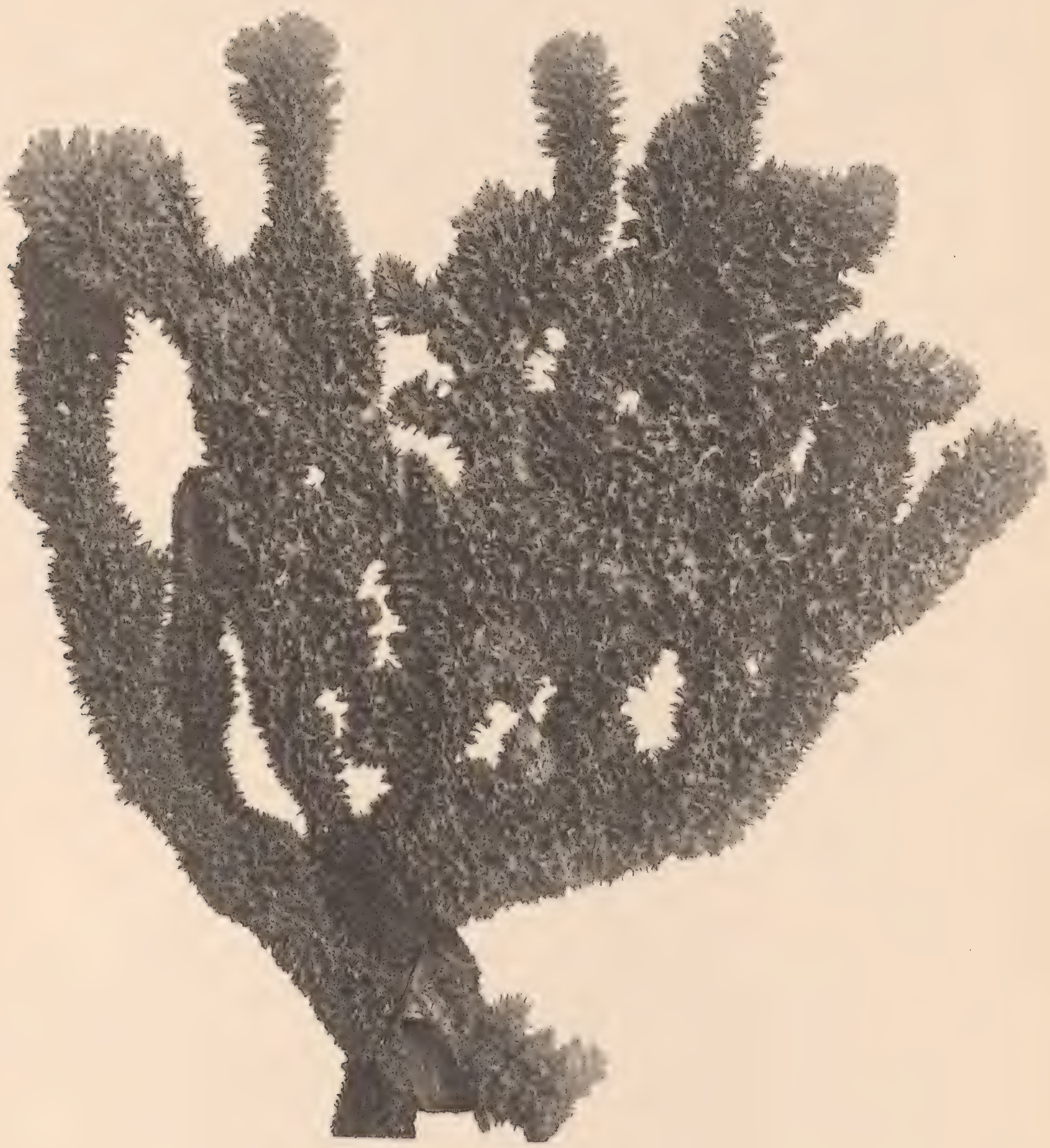
NEW SPONGE.

THE HELIOTYPE PRINTING CO., BOSTON.

EXPLANATION OF PLATE V.

Hircinia atra Whitf., page 49.

View of half of the type specimen reduced to one-half natural size.



NEW SPONGE.

THE HELIOTYPE PRINTING CO., BOSTON.

Hircinia purpurea *Whitf.*, sp. nov.

PLATE IV.

The type specimen of this form is globular, 16 centimeters (about six inches) in diameter, and nearly or quite as high. There is only one main orifice to the specimen. This is 5 by 6.5 centimeters in dimensions, is nearly in the center, and reaches far into the interior. Into it numerous spiracles of various smaller sizes open, giving the interior a very cavernous appearance. The exterior is of a close, Hircinian texture, hard and rigid in character, not soft and flexible even when living, like most other forms of the genus. The color of the living specimen was a medium dark purple. In drying this became a light purple and it remains so after more than two years' exposure to the light in the Museum cases. The specimen was obtained alive in Nassau Harbor, N. P., a few miles east of the city, beyond Quarantine Key, in March, 1898.

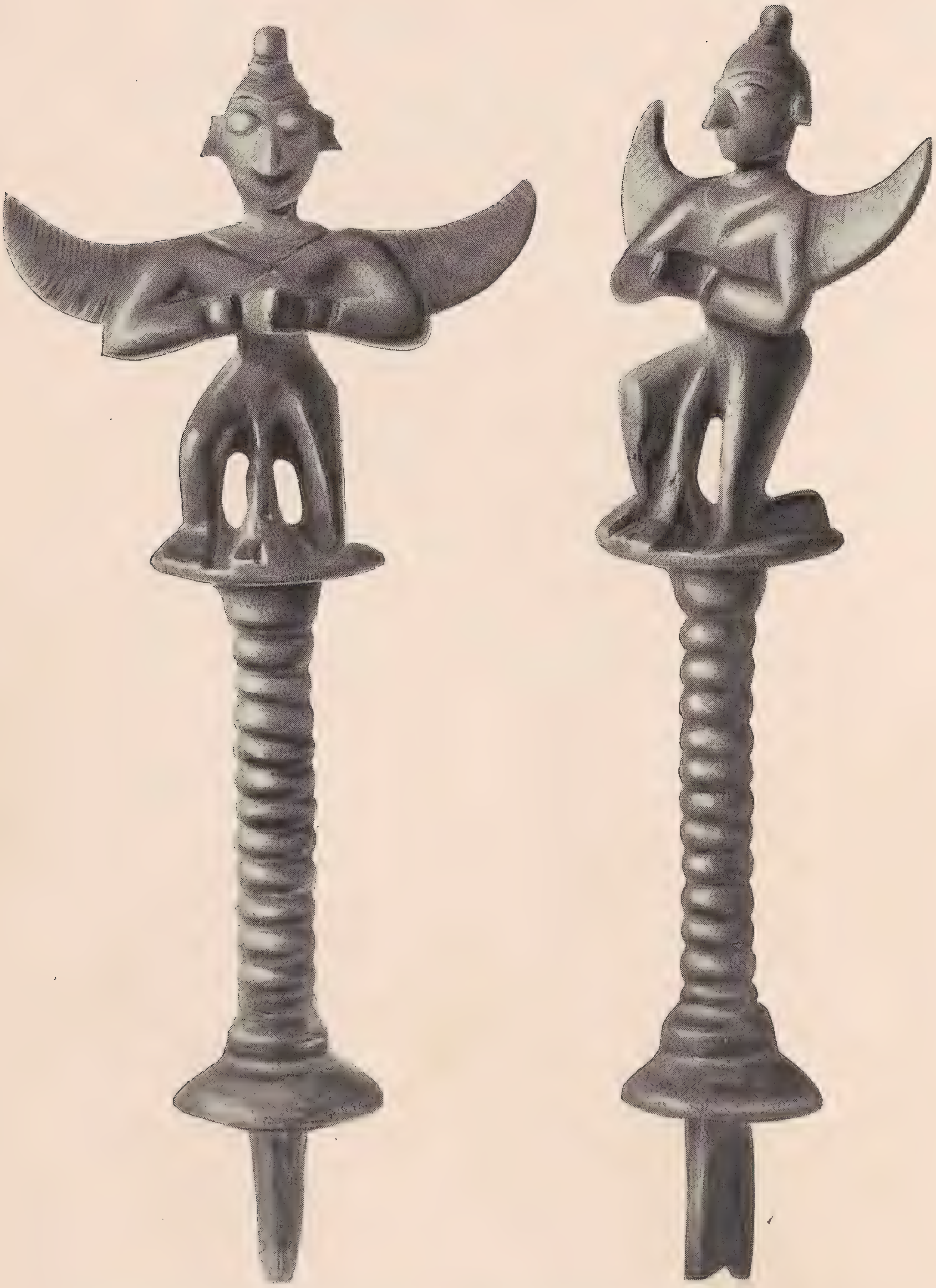
A dark purple form representing the common features of *H. acuta* was also obtained at Bird Key, east of Nassau, N. P., and a similar form, but soft and flexible, was collected in Harrington Sound, Bermuda, in March, 1895. The latter still retains its dark, purple-black color after three years' immersion in alcohol. This can hardly be considered as specifically identical with, or as being of the same variety as, the rigid form herein described.

Hircinia atra *Whitf.*, sp. nov.

PLATE V.

In color this form bears some resemblance to *Hircinia nigra* Hyatt, but it is profusely branched and grows to be 60 centimeters (two feet) or more in height. The branching stems are generally about two cm. in diameter, with many broader, subpalmate areas where new branches are given off. The whole forms a dendroid or bush-like mass. The general aspect is precisely that of *H. acuta*, except in the color and greater rigidity. Its color when living is a deep, shining black, which it retains in the dried state. When the sponge is fresh, however, the color is readily given off on being squeezed in water, or even on being handled, however gently.

This form is found very sparingly around Nassau, but in the harbor a little east of the lighthouse, or opposite the city, there was a small area, seventy-five or a hundred feet along the harbor near Hog island, where it was very abundant and owing to its deep black color was very conspicuous in more than twenty feet of water.



Bronze Figurine from British Columbia. (Height, 16 cm.)

Article V.—A BRONZE FIGURINE FROM BRITISH COLUMBIA.

By Franz Boas.

In 1894, while visiting the village of Kincolith on Nass River, in northern British Columbia, my attention was called to an interesting bronze figure, then in the possession of Rev. W. H. Collison. The figure was evidently cast showing a distinct seam. The method of manufacture as well as the form of the figure suggested at once a foreign origin. According to the testimony of Mr. Collison, which was borne out by remarks of Indians who had seen the object, the same was found in digging over a potato-patch on a place which had formerly been covered with heavy timber. It does not seem at all likely that the specimen should have got into this position recently.

I submitted a cast and photographs of the figure to Prof. Albert Grünwedel of Berlin, to whom I am indebted for the following statement. A comparison with a number of bells in the Royal Ethnographical Museum in Berlin (catalogue Nos. 16890, 2501, 10960, 8674, 16707) proves that the object in question must be considered as the handle of a ghaṇṭâ, which is a bell used by the Brâhmaṇa in the Pûjâ ceremony. The small flattened projection seen under the beaded column which forms the handle was originally riveted into the bell. The specimen is most easily identified by this beaded column. All the bells mentioned before come from Bengal, Orissa, and Nepaul. The kneeling winged figure on top of the column is undoubtedly a Garuḍa, characterized by the wings attached to its upper arms, the beak-like nose, the somewhat degenerate head-dress, and the drapery hanging down from the waist.

None among the very modern bells of the Berlin Museum is identical with the present specimen. The nearest approach to it is No. 2501, on which the Garuḍa is represented kneeling on the top of the handle. This piece comes from Âsikâ (Asca), Orissa. Nos. 8674 and 16707, from Orissa and Bengal, show the kneeling Garuḍa at the side of Hanumân. A very small bell (No. 10960) from Nepaul, and another one (No. 16890) from Calcutta, have a standing figure of Garuḍa, the forms of which resemble closely those of the kneeling figure of the present specimen.

It is not possible to determine the age of the specimen definitely. It may be a hundred years old or a little older. It is not more recent, although the workmanship is very crude. Thus far Professor Grünwedel's statement.

An analysis of the bronze, which Prof. Morris Loeb of New York had the kindness to make for me, shows the bronze to be composed of

	Per cent.
Copper	68.99
Zinc	27.2
Lead	1.2
Tin	2.26
	99.65

The specific gravity of the bronze is 8.642.

Prof. Loeb adds, that the amount given as tin may contain some antimony, but, as this admixture did not seem of importance in regard to the provenience of the specimen, the analysis was not carried any further.

It seems probable that this specimen may have been carried to the North Pacific Coast by Spanish vessels. Prof. Otis T. Mason, who has paid much attention to the question of intercourse between Mexico and the Malay Archipelago, states, in a letter to the writer, that "it is a matter of well authenticated history that from 1570, for a period of two hundred years, a royal fleet of Spain passed over from Acapulco to Manila every year, carrying on the most vigorous trade. This fleet passed outward following the tropical current, but returned following the northern route, and skirting the coast of America all the way from Alaska to Mexico. Mexican and Peruvian silver passed outward, and was eagerly sought for in trade by the Chinese, Cambodians, and Siamese, and by other peoples of southeastern Asia. There is not the slightest embarrassment in the way of this bronze image having been transported from Manila to British Columbia at any period between 1570 and 1770."

Article VI.—A. J. STONE'S MEASUREMENTS OF NATIVES OF THE NORTHWEST TERRITORIES.

By Franz Boas.

Plates VII–XI.

During the years 1897–99, Mr. A. J. Stone made an extended journey through the Northwest Territories for the American Museum of Natural History, the required funds being provided through the liberality of the late Mr. James M. Constable. On this journey he collected a number of measurements of Indians and Eskimo, which were placed in the hands of the writer for discussion. Anthropometric data from this area are so scanty that the material collected by Mr. Stone is highly welcome. The measurements embrace 36 Tahltan (23 males and 13 females), 10 Loucheux from Fort McPherson (8 males and 2 females), 20 Nunatagmiut (15 males and 5 females), and 20 Koukpagmiut (14 males and 6 females). The two first-named tribes belong to the Athapascan family; the two last-named are Eskimo. The place of birth of the Nunatagmiut is given as being inland on Noatak River, in Alaska; that of the Koukpagmiut, as Kittygagzyooit, which is east of the mouth of the Mackenzie.

Mr. Stone employed the same scheme of measurements which I used in my collections for the World's Columbian Exposition. This scheme embraces twelve measurements: 1. Stature (abbreviated as St); 2. Stretch of arms (Str); 3. Height of shoulder (Sh); 4. Height of point of second finger; 4*a*. Length of arm (A), being the difference between 3 and 4; 5. Height sitting (Hs); 6. Width of shoulders (Wsh); 7. Length of head (Lh); 8. Breadth of head (Bh); 9. Width of face (Wf); 10. Height of face (Hf); 11. Height of nose (Hn); 12. Width of nose (Wn). Besides these, the following data are recorded in the list of measurements which is given at the end of this paper: proportion of stretch of arms, length of arm, height sitting, and width of shoulders, to stature (*IStr*, *IA*, *IHs*, *IWsh*), cephalic index (*CI*), and facial index (*IF*).

I give first a tabulation of the observation of full-blooded men recorded by Mr. Stone.

STATURE.					STRETCH OF ARMS.					HEIGHT OF SHOULDER.					LENGTH OF ARM.					HEIGHT SITTING.				
	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.		Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.		Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.		Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.		Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
155	—	—	—	—	160	—	—	—	—	130	—	2	1	—										
156	—	—	—	—	161	—	—	—	—	131	—	—	—	—										
157	—	1	—	—	162	—	—	—	—	132	—	—	1	—						82	—	—	—	1
158	—	—	—	—	163	—	1	—	—	133	—	—	1	—						83	—	1	—	—
159	—	—	—	—	164	—	—	—	—	134	—	—	2	—	69	—	1	—	—	84	1	1	1	1
160	—	—	2	—	165	—	—	2	—	135	—	—	—	—	70	—	1	2	—	85	—	—	1	2
161	—	—	—	1	166	1	—	—	—	136	1	1	1	1	71	1	—	2	1	86	—	1	1	1
162	—	1	1	—	167	—	—	—	—	137	—	—	—	3	72	—	—	1	2	87	—	—	1	1
163	—	1	—	1	168	—	—	3	—	138	2	—	—	1	73	1	—	1	2	88	4	—	—	1
164	—	—	2	—	169	—	—	1	2	139	1	—	1	—	74	—	1	1	2	89	—	2	1	2
165	1	—	1	1	170	1	1	1	—	140	2	3	1	2	75	2	3	1	1	90	4	—	1	2
166	1	—	—	2	171	—	1	—	3	141	1	—	—	1	76	5	—	1	2	91	2	1	1	—
167	1	—	—	1	172	2	1	—	1	142	2	1	—	—	77	3	—	2	1	92	4	—	2	—
168	1	—	—	—	173	1	—	—	1	143	4	—	1	2	78	2	1	—	—	93	1	—	2	—
169	1	2	1	—	174	—	1	—	1	144	1	—	—	—	79	2	—	—	—	94	—	1	1	—
170	1	—	2	2	175	—	—	—	—	145	3	—	1	1	80	—	—	—	—	95	—	—	—	—
171	3	1	—	—	176	3	1	—	1	146	—	—	—	—	81	1	—	1	—	96	1	—	—	—
172	1	—	—	1	177	1	—	1	—	147	—	—	1	—										
173	4	1	1	1	178	1	—	—	1	148	—	—	—	—										
174	1	—	1	1	179	—	—	—	1	149	—	—	—	—										
175	1	—	—	—	180	4	—	2	—	150	—	—	—	—										
176	1	—	—	—	181	—	—	—	—	151	—	—	1	—										
177	—	—	—	—	182	—	—	—	—	152	—	—	—	—										
178	—	—	—	—	183	—	1	1	—	153	—	—	—	—										
179	—	—	1	—	184	2	—	—	—	154	—	—	—	—										
180	—	—	—	—	185	1	—	—	—															
Number of cases.	17	7	12	11		17	7	11	11		17	7	12	11		17	7	12	11		17	7	12	11
Average.	171.0	166.3	167.5	167.9		177.0	172.7	172.1	173.0		141.5	136.9	138.7	139.7		76.5	73.7	73.9	73.9		90.3	88.1	89.3	86.8

WIDTH OF SHOULDERS.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
34	—	—	1	1
35	2	2	—	1
36	2	2	1	—
37	3	—	2	1
38	3	1	2	3
39	6	2	1	3
40	1	—	3	1
41	—	—	2	1
No. of cases,	17	7	12	11
Average,	37·7	36·9	38·4	38.0

LENGTH OF HEAD.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
180	—	—	—	—
181	—	—	—	—
182	—	—	—	1
183	—	—	—	2
184	—	—	—	—
185	—	—	—	—
186	2	1	—	3
187	—	—	—	—
188	1	—	—	—
189	2	—	1	2
190	1	—	—	—
191	1	—	1	—
192	1	2	3	—
193	2	2	2	—
194	—	—	—	—
195	1	—	—	—
196	1	—	—	—
197	2	1	1	1
198	—	—	—	—
199	1	—	1	2
200	1	—	1	—
201	—	—	—	—
202	—	—	1	—
203	—	—	1	—
204	1	—	—	—
205	—	—	—	—
206	—	—	—	—
207	—	1	—	—
No. of cases,	17	7	12	11
Average,	193.2	194.3	195.2	189.0

WIDTH OF HEAD.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
135	—	—	1	—
136	—	—	—	—
137	—	—	1	—
138	—	—	1	—
139	—	—	—	—
140	—	—	—	—
141	—	—	1	—
142	—	—	—	—
143	—	—	—	—
144	—	—	2	—
145	—	1	—	1
146	—	—	1	—
147	—	—	1	—
148	—	1	2	—
149	—	—	—	—
150	—	—	2	—
151	2	—	—	—
152	—	—	—	1
153	—	—	—	3
154	1	1	—	2
155	3	1	—	—
156	—	2	—	2
157	—	—	—	—
158	—	1	—	—
159	—	—	—	1
160	3	—	—	—
161	3	—	—	—
162	1	—	—	—
163	—	—	—	—
164	1	—	—	—
165	—	—	—	1
166	2	—	—	—
170	1	—	—	—
No. of cases,	17	7	12	11
Average,	159.5	153.1	144.0	154.5

HEIGHT OF FACE.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
115	—	—	—	1
116	—	1	—	—
117	—	—	—	—
118	—	1	—	—
119	1	—	—	—
120	1	—	2	—
121	—	—	—	—
122	2	1	—	2
123	—	1	1	—
124	—	—	—	—
125	—	1	—	1
126	2	1	1	—
127	—	—	—	—
128	1	—	—	1
129	—	—	1	—
130	—	1	—	—
131	1	—	1	2
132	3	—	1	2
133	2	—	—	1
134	2	—	1	—
135	1	—	—	—
136	—	—	1	—
137	—	—	—	—
138	1	—	—	—
139	—	—	—	—
140	—	—	—	—
141	—	—	1	1
142	—	—	—	—
143	—	—	2	—
No. of cases,	17	7	12	11
Average,	129.2	122.9	131.5	128.4

WIDTH OF FACE.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
135	1	—	—	—
136	—	—	—	—
137	—	—	1	—
138	—	—	—	—
139	—	—	—	—
140	—	—	—	—
141	—	—	—	—
142	—	—	—	—
143	—	—	2	—
144	1	—	—	1
145	—	2	—	—
146	2	1	1	—
147	—	1	2	—
148	2	—	1	—
149	—	—	1	—
150	2	1	—	—
151	—	—	1	—
152	2	1	—	1
153	—	—	—	1
154	3	—	1	1
155	2	1	1	2
156	—	—	1	—
157	—	—	—	1
158	—	—	—	1
159	—	—	—	1
160	1	—	—	—
161	—	—	—	—
162	1	—	—	1
163	—	—	—	—
164	—	—	—	1
No. of cases,	17	7	12	11
Average,	150.9	148.6	148.0	155·7

HEIGHT OF NOSE.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
49	—	—	—	1
50	—	—	1	—
51	—	—	—	—
52	—	2	2	—
53	2	1	—	—
54	2	1	1	1
55	3	—	1	1
56	1	2	—	4
57	—	1	1	—
58	2	—	—	1
59	4	—	2	1
60	1	—	1	2
61	1	—	2	—
62	—	—	—	—
63	—	—	1	—
64	1	—	—	—
No. of cases,	17	7	12	11
Average,	57·2	54·3	57·0	56·3

WIDTH OF NOSE.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
30	—	—	—	—
31	—	—	—	1
32	1	—	—	—
33	2	—	—	—
34	2	—	—	1
35	3	1	1	—
36	4	—	1	2
37	1	—	2	1
38	1	2	2	1
39	1	1	1	2
40	2	3	3	—
41	—	—	1	2
42	—	—	1	1
No. of cases,	17	7	12	11
Average,	35.8	38.6	38.6	37.6

INDEX LENGTH OF ARM.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
40	—	—	—	—
41	—	—	1	—
42	—	—	1	1
43	2	1	3	1
44	4	4	2	5
45	5	—	2	4
46	6	2	3	—
47	—	—	—	—
No. of cases,	17	7	12	11
Average,	44.9	44.4	44.0	44.1

INDEX OF STRETCH OF ARMS.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
98	—	1	1	—
99	—	—	1	—
100	1	—	2	1
101	3	—	—	—
102	1	1	3	3
103	2	1	—	2
104	5	1	1	3
105	2	—	1	2
106	2	1	3	—
107	1	1	—	—
108	—	1	—	—
No. of cases,	17	7	12	11
Average,	103.5	104.0	102.5	103.1

INDEX HEIGHT SITTING.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
49	1	—	—	—
50	—	—	—	1
51	1	1	—	3
52	3	1	4	2
53	8	3	2	3
54	2	2	3	1
55	2	—	2	—
56	—	—	1	—
57	—	—	—	—
58	—	—	—	—
59	—	—	—	1
No. of cases,	17	7	12	11
Average,	52.8	52.9	53.5	52.6

INDEX WIDTH OF SHOULDERS.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
20	1	1	—	—
21	4	1	1	3
22	6	2	4	2
23	5	2	3	2
24	1	1	4	4
No. of cases,	17	7	12	11
Average,	22.1	22.1	22.8	22.6

CEPHALIC INDEX.	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
70	—	—	2	—
71	—	—	1	—
72	—	—	1	—
73	—	—	2	—
74	—	—	1	—
75	—	3	1	—
76	—	—	1	1
77	—	—	1	—
78	—	—	2	1
79	2	—	—	1
80	3	—	—	—
81	4	2	—	1
82	2	1	—	3
83	—	1	—	1
84	1	—	—	2
85	1	—	—	—
86	1	—	—	—
87	2	—	—	1
88	1	—	—	—
No. of cases,	17	7	12	11
Average,	82.5	78.9	73.9	81.6

The number of observations is so small that no stress can be laid upon the variability of each series. Following is a condensed table of averages :

	MEN.				WOMEN.		
	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.	Tahltan.	Koukpagmiut.	Nunatagmiut.
Stature	1710	1663	1675	1679	1603	1515	1556
Stretch of Arms	1770	1727	1721	1730	1613	1513	1592
Height of Shoulder	1415	1369	1387	1397	1310	1228	1284
Length of Arm	765	737	739	739	690	645	660
Height Sitting	903	881	893	868	853	812	818
Width of Shoulders	377	369	384	380	350	337	342
Length of Head	193.2	194.3	195.2	189.0	190.7	187.8	181.0
Width of Head	159.5	153.1	144.0	154.5	153.3	141.5	142.6
Width of Face	150.9	148.6	147.8	155.7	146.0	139.7	144.6
Height of Face	129.2	122.9	131.5	128.4	118.7	120.8	119.8
Height of Nose	57.2	54.3	57.0	56.3	54.7	52.8	53.0
Width of Nose	35.8	38.6	38.6	37.6	34.0	33.2	33.4
Index of Stretch of Arms.	103.5	104.0	102.5	103.1	101.0	100.3	102.4
Index of Arm	44.9	44.4	44.0	—	43.0	42.7	42.6
Index of Height Sitting.	52.8	52.9	53.5	52.6	53.0	53.7	52.4
Index of Width of Shoulders	22.1	22.1	22.8	22.6	22.0	22.2	22.0
Cephalic Index	82.5	78.9	73.9	81.6	80.3	75.2	78.8
Cases	17	7	12	11	3	6	5

It would seem from these data that the sharp distinction between the physical types of the Eskimo and of the Indians, which we find all along the Arctic coast, is also well marked on the Mackenzie River. The Eskimo of that district are not as short as those of the east, a fact which has been remarked upon by many travellers.[1] They seem to be shorter, however, than the neighboring Athapascan tribes. Their heads are much less elongated than those of the eastern Eskimo, and in this respect they resemble the Alaskan Eskimo.[1] Mr. Stone mentions that the Nunatagmiut were originally an inland people, and that they used to visit the coast of Bering Sea for the purpose of barter. It seems likely, therefore, that they are closely allied to the Alaskan Eskimo. Their head measurements are particularly remarkable on account of the low value of length of head and the resultant high value of breadth of head and high cephalic index.

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[1] E. Petitot: Vocabulaire Français-Esquimau (Paris, 1876), p. xii.

In order to make this clearer, I have combined in the following table the cephalic indices of the whole series (children and adults, males and females), which is justifiable on account of the slight differences of the cephalic indices of individuals of the two sexes and of different ages.[2]

CEPHALIC INDEX.

	Tahltan.	Loucheux.	Koukpagmiut.	Nunatagmiut.
70	—	—	4	—
71	—	—	1	—
72	—	—	1	—
73	—	—	3	—
74	—	—	3	1
75	—	3	1	—
76	—	—	2	1
77	1	—	2	2
78	—	—	2	3
79	3	—	—	1
80	3	—	—	—
81	5	3	1	1
82	5	1	—	5
83	4	1	—	1
84	2	—	—	2
85	1	—	—	—
86	2	—	—	1
87	3	—	—	2
88	2	—	—	—
89	—	—	—	—
No. of cases,	31	8	20	20
Average,	82.7	79.1	73.1	81.0

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[1] J. Barnard Davis: Thesaurus Craniorum (London, 1867), p. 224.

[2] F. Boas: Zur Anthropologie der nordamerikanischen Indianer. (Verh. d. Berl. Ges. f. Anthrop., 1895, vol. xxvii, p. 392.)

Notwithstanding this peculiarity of the Nunatagmiut, the fundamental feature of the Eskimo skull, which consists in great breadth of face as compared to narrowness of skull, is well marked. The contrast between the two Eskimo tribes and the two Indian tribes is very striking, as is illustrated by the following data.

PROPORTION OF WIDTH OF FACE AND OF HEAD.

	Tahltan.		Loucheux.		Koukpagmiut.		Nunatagmiut.	
	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.
81	1		—		—		—	
82	—		—		—		—	
83	—		—		—		—	
84	—		—		—		—	
85	—		—		—		—	
86	—		—		—		—	
87	1		—		—		—	
88	—		—		—		—	
89	1		—		—		—	
90	—	—	—	—	—		—	
91	—	—	—	—	—		—	
92	—	1	—	1	—		1	
93	1	2	2	—	—		—	
94	1	—	—	—	—		—	
95	4	1	—		—	—	—	—
96	3	—	1		—	1	1	—
97	2	—	1		1	1	—	—
98	—	—	—		—	1	—	—
99	1	1	2		3	1	2	2
100	—		—		—	—	1	1
101	1		1		1	1	1	—
102	1		—		—	—	3	—
103	—		—		1	1	1	—
104	—		—		2	—	—	—
105	—		—		1		—	2
106	—		—		2		1	—
107	—		—		—		1	—
108	—		—		—		—	—
109	—		—		1		—	—
No. of cases,	17	5	7	1	12	6	12	5
Average,	94.8	94.4	96.9		102.7	99.0	100.8	101.6

The same features are characteristic of Eskimo skulls of other regions, with the exception of Labrador and Greenland, where there is a strong admixture of white blood. In the following table I give the width of head and face and the proportions as recorded by various authors.

		Breadth of Head.	Breadth of Face.	Breadth of Face divided by Breadth of Head.
Skulls.	Herschell Island[1]	137	139	101
"	Greenland,[2] 5 Men	140	147	105
"	" 5 Women	130	130	100
"	West Coast of Baffin Bay,[3] 5 Men	135	137	102
"	West Coast of Baffin Bay, 2 Women	132	124	94
"	Alaska,[4] 4 Men	135	140	104
"	East Greenland,[5] 15	133	136	102
"	Smith Sound,[6] 85	130	133	102
Heads.	Labrador,[7] 3 Men	149	147	99
"	" 2 Women	137	134	98
"	" [8] 10 Men	149	142	95
"	West Greenland (half-bloods),[9] Men	148.5	141.3	95
"	West Greenland (half-bloods), Women	142.3	136.3	96

Measurements of other dolichocephalic skulls, such as are given in Barnard Davis's 'Thesaurus Craniorum,' do not show this peculiar feature. In other narrow-headed American types the following values for width of head and of face were found :

		Breadth of Head.	Breadth of Face.	Breadth of Face divided by Breadth of Head.
Skulls.	Caves of Coahuila, Mexico,[10] 16 Males	135	133	99
"	Tarahumare,[11] 25 Males	137	134	98
"	Prehistoric, from Southern Utah,[11] 21	131	134	102

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[1] Frank Russell: Explorations in the Far North (University of Iowa, 1898), p. 200.

[2] J. Barnard Davis: Thesaurus Craniorum (London, 1867), p. 221.

[3] *Ibid.*, p. 222.

[4] *Ibid.*, p. 223.

[5] Bulletin de la Société d'Anthropologie, III. Series, vol. ix, p. 616.

[6] Archiv für Anthropologie, 1875, vol. viii., p. 107.

[7] R. Virchow: Eskimos von Labrador. (Verh. d. Berl. Ges. für Anthr., 1880, vol. xii, p. 272.)

[8] Measurements obtained for me by Prof. L. S. Lee of Bowdoin College in 1891.

[9] Sœren Hansen: Bidrag til Vestgrœnlændernes Anthropologi. (Meddelelser om Grœnland, No. 7, 1893, pp. 210, 218.)

[10] Cordelia A. Studley: Notes upon Human Remains from the Caves of Coahuila, Mexico. (XVI. Report of the Peabody Museum of American Archæology and Ethnology, Cambridge, 1883, pp. 252–259.)

[11] According to data kindly furnished me by Dr. A. Hrdlička.

It appears from these data, that, although this index is high among the tribes of the Southwest, narrowness of skull is not necessarily correlated with great breadth of face.

The Tahltan and Loucheux resemble the type of the northern coast of British Columbia,[1] as the following table of average measurements of men will show.

	Northern Coast of British Columbia.	Tahltan.	Chilcotin.
Stature	1675	171	165
Length of Head	195	193	187
Breadth of Head	161	160	159
Breadth of Face	154	151	148
Height of Face	122	129	124

I am inclined to think that this very high value of height of face is due to a peculiarity of Mr. Stone's method of measurement, since it exceeds all known values of this measurement from the Pacific coast. The same is probably true of the height of the nose. I have also given in the table the measurements of Chilcotin Indians.[2] It appears that these, although belonging to the Athapascan linguistic stock, are more closely allied in type to the Salish tribes of the interior of British Columbia than to other northern Athapascans.

LIST OF MEASUREMENTS.

TAHLTAN.

I. *Males.*

1. Age 9, Jack. — St 1270 Str 880 Sh 1002 A 522 Hs 670 Wsh 270 — Lh 176 Bh 153 Wf 137 Hf 113 Hn 46 Wn 27 — *IStr* 69.3 *IA* 41.1 *IHs* 52.8 *IWsh* 21.3 — *CI* 87.0 *IF* 82.5.
2. Age 12, Archie. — St 1395 Str 1400 Sh 1135 A 590 Hs 742 Wsh 290 — Lh 192 Bh 151 Wf 134 Hf 115 Hn 48 Wn 28 — *IStr* 100.4 *IA* 42.4 *IHs* 53.4 *IWsh* 20.9 — *CI* 78.6 *IF* 85.8.
3. Age 18, Ned. — St 1642 Str 1720 Sh 1355 A 730 Hs 867 Wsh 320 — Lh 186 Bh 154 Wf 140 Hf 123 Hn 54 Wn 34 — *IStr* 104.8 *IA* 44.5 *IHs* 52.9 *IWsh* 19.5 — *CI* 82.8 *IF* 87.9.

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[1] Twelfth and Final Report on the Northwestern Tribes of Canada. (British Association for the Advancement of Science, 1898, p. 15.)

[2] *Ibid.*, pp. 3 ff.

4. Age 20, Bill. — St 1720 Str 1782 Sh 1430 A 768 Hs 842 Wsh 362 — Lh 196 Bh 170 Wf 148 Hf 126 Hn 56 Wn 34 — *IStr* 103.6 *IA* 44.7 *IHs* 49.0 *IWsh* 21.0 — *CI* 86.7 *IF* 85.1.
5. Age 20, Bear Lake Jim. — St 1735 Str 1800 Sh 1430 A 760 Hs 902 Wsh 372 — Lh 186 Bh 164 Wf 146 Hf 133 Hn 55 Wn 36 — *IStr* 103.7 *IA* 43.7 *IHs* 51.8 *IWsh* 21.4 — *CI* 88.2 *IF* 91.1.
6. Age 22, Tudeek. — St 1732 Str 1800 Sh 1425 A 765 Hs 880 Wsh 387 — Lh 200 Bh 162 Wf 160 Hf 132 Hn 53 Wn 34 — *IStr* 104.0 *IA* 44.2 *IHs* 50.9 *IWsh* 22.4 — *CI* 81.0 *IF* 82.5.
7. Age 22, M. Clusky. — St 1710 Str 1730 Sh 1410 A 728 Hs 920 Wsh 397 — Lh 189 Bh 155 Wf 150 Hf 135 Hn 58 Wn 39 — *IStr* 101.2 *IA* 42.6 *IHs* 53.8 *IWsh* 23.2 — *CI* 82.0 *IF* 89.9.
8. Age 22, Dennis. — St 1710 Str 1720 Sh 1430 A 790 Hs 912 Wsh 370 — Lh 197 Bh 160 Wf 152 Hf 132 Hn 59 Wn 33 — *IStr* 100.6 *IA* 46.2 *IHs* 53.3 *IWsh* 21.6 — *CI* 81.2 *IF* 86.8.
9. Age 27, Lonie. — St 1735 Str 1835 Sh 1435 A 770 Hs 925 Wsh 385 — Lh 199 Bh 161 Wf 154 Hf 133 Hn 59 Wn 37 — *IStr* 105.8 *IA* 44.5 *IHs* 53.5 *IWsh* 22.3 — *CI* 80.9 *IF* 86.4.
10. Age 27, Jackson. — St 1700 Str 1760 Sh 1400 A 760 Hs 900 Wsh 385 — Lh 188 Bh 155 Wf 148 Hf 134 Hn 54 Wn 33 — *IStr* 103.5 *IA* 44.7 *IHs* 52.9 *IWsh* 22.6 — *CI* 82.4 *IF* 90.5.
11. Age 27, George. — St 1730 Str 1800 Sh 1450 A 793 Hs 917 Wsh 360 — Lh 193 Bh 155 Wf 146 Hf 122 Hn 55 Wn 32 — *IStr* 104.0 *IA* 45.8 *IHs* 53.0 *IWsh* 20.8 — *CI* 80.3 *IF* 83.6.
12. Age 27, Harry Berkley. — St 1665 Str 1770 Sh 1385 A 760 Hs 885 Wsh 370 — Lh 190 Bh 160 Wf 152 Hf 126 Hn 60 Wn 35 — *IStr* 106.3 *IA* 45.5 *IHs* 53.0 *IWsh* 22.2 — *CI* 84.2 *IF* 82.9.
13. Age 30, Larry Martin. — St 1650 Str 1720 Sh 1360 A 753 Hs 907 Wsh 390 — Lh 189 Bh 151 Wf 154 Hf 128 Hn 61 Wn 38 — *IStr* 104.2 *IA* 45.6 *IHs* 55.0 *IWsh* 23.6 — *CI* 79.9 *IF* 83.1.
14. Age 30, Packen Johnie. — St 1760 Str 1850 Sh 1450 A 805 Hs 930 Wsh 355 — Lh 193 Bh 166 Wf 135 Hf 119 Hn 54 Wn 35 — *IStr* 105.1 *IA* 45.7 *IHs* 52.8 *IWsh* 20.2 — *CI* 86.0 *IF* 88.1.
15. Age 34, Dandy Jim. — St 1730 Str 1760 Sh 1435 A 778 Hs 955 Wsh 380 — Lh 195 Bh 166 Wf 155 Hf 132 Hn 64 Wn 40 — *IStr* 101.7 *IA* 45.0 *IHs* 55.2 *IWsh* 22.0 — *CI* 85.1 *IF* 85.2.
16. Age 35, Jackson. — St 1710 Str 1760 Sh 1422 A 762 Hs 915 Wsh 395 — Lh 197 Bh 160 Wf 154 Hf 138 Hn 59 Wn 36 — *IStr* 103.0 *IA* 44.6 *IHs* 53.5 *IWsh* 23.1 — *CI* 81.2 *IF* 89.6.
17. Age 36, Benny. — St 1690 Str 1800 Sh 1395 A 770 Hs 900 Wsh 390 — Lh 191 Bh 151 Wf 144 Hf 122 Hn 55 Wn 35 — *IStr* 106.5 *IA* 45.6 *IHs* 53.3 *IWsh* 23.1 — *CI* 79.1 *IF* 84.7.
18. Age 37, Ches-ul-ta. — St 1660 Str 1665 Sh 1380 A 708 Hs 880 Wsh 375 — Lh 192 Bh 154 Wf 150 Hf 131 Hn 53 Wn 36 — *IStr* 100.3 *IA* 42.7 *IHs* 53.0 *IWsh* 22.6 — *CI* 80.2 *IF* 87.3.

II. *Females.*

19. Age 4, Lonie. — St 927 Str 940 Sh 702 A 387 Hs 510 Wsh 215 — Lh 163 Bh 134 Wf 111 Hf 81 Hn 35 Wn 22 — *IStr* 101.4 *IA* 42.1 *IHs* 55.4 *IWsh* 23.4 — *CI* 82.8 *IF* 73.0.

20. Age 8, Maggie. — St 1140 Str 1150 Sh 890 A 495 Hs 615 Wsh 250 — Lh 168 Bh 114 Wf 118 Hf 98 Hn 50 Wn 25 — *IStr* 100.9 *IA* 43.4 *IHs* 54.0 *IWsh* 22.0 — *CI* 67.9 *IF* 83.1.

21. Age 14, Emma. — St 1472 Str 1470 Sh 1170 A 615 Hs 790 Wsh 320 — Lh 189 Bh 156 Wf 134 Hf 111 Hn 54 Wn 29 — *IStr* 99.8 *IA* 41.8 *IHs* 53.7 *IWsh* 21.8 — *CI* 82.5 *IF* 82.8.

22. Age 14, Susie. — St 1510 Str 1560 Sh 1235 A 668 Hs 740 Wsh 315 — Lh 180 Bh 155 Wf 139 Hf 111 Hn 47 Wn 33 — *IStr* 103.3 *IA* 44.2 *IHs* 49.0 *IWsh* 20.9 — *CI* 86.1 *IF* 79.9.

23. Age 15, Annie. — St 1510 Str 1540 Sh 1265 A 670 Hs 825 Wsh 307 — Lh 180 Bh 147 Wf 136 Hf 113 Hn 49 Wn 31 — *IStr* 102.0 *IA* 44.4 *IHs* 54.6 *IWsh* 20.3 — *CI* 81.7 *IF* 83.1.

24. Age 15, Ya't, seq. — St 1540 Str 1630 Sh 1262 A 692 Hs 795 Wsh 345 — Lh 176 Bh 154 Wf 143 Hf 114 Hn 52 Wn 33 — *IStr* 105.8 *IA* 44.9 *IHs* 51.6 *IWsh* 22.4 — *CI* 87.5 *IF* 79.7.

25. Age 16, Lizzie. — St 1600 Str 1610 Sh 1300 A 688 Hs 872 Wsh 360 — Lh 186 Bh 153 Wf 145 Hf 113 Hn 49 Wn 32 — *IStr* 100.7 *IA* 43.0 *IHs* 54.5 *IWsh* 22.5 — *CI* 82.3 *IF* 77.9.

26. Age 18, Kittie. — St 1665 Str 1720 Sh 1387 A 730 Hs 877 Wsh 370 — Lh 183 Bh 154 Wf 143 Hf 120 Hn 49 Wn 35 — *IStr* 103.3 *IA* 44.0 *IHs* 52.8 *IWsh* 22.3 — *CI* 84.2 *IF* 83.9.

27. Age 20, Matilda Campbell. — St 1640 Str 1700 Sh 1350 A 713 Hs 877 Wsh 365 — Lh 186 Bh 155 Wf 153 Hf 117 Hn 51 Wn 33 — *IStr* 103.7 *IA* 43.5 *IHs* 53.5 *IWsh* 22.3 — *CI* 83.3 *IF* 76.5.

28. Age 22, Lucy. — St 1640 Str 1600 Sh 1335 A 698 Hs 860 Wsh 360 — Lh 198 Bh 160 Wf 147 Hf 122 Hn 60 Wn 36 — *IStr* 97.6 *IA* 42.6 *IHs* 52.4 *IWsh* 22.0 — *CI* 80.8 *IF* 83.0.

29. Age 35, Susie. — St 1525 Str 1540 Sh 1250 A 663 Hs 820 Wsh 332 — Lh 188 Bh 145 Wf 138 Hf 117 Hn 53 Wn 33 — *IStr* 101.0 *IA* 43.3 *IHs* 53.6 *IWsh* 21.7 — *CI* 77.1 *IF* 84.8.

TAHLTAN HALF-BLOODS.

I. *Males.*

30. Age 21, George Williams. — St 1690 Str 1720 Sh 1400 A 775 Hs 910 Wsh 350 — Lh 180 Bh 170 Wf 146 Hf 118 Hn 54 Wn 34 — *IStr* 101.8 *IA* 45.9 *IHs* 53.8 *IWsh* 20.7 — *CI* 94.4 *IF* 80.8.

31. Age 24, Johnie Campbell. — St 1670 Str 1750 Sh 1405 A 785 Hs 930 Wsh 405 — Lh 188 Bh 159 Wf 145 Hf 134 Hn 67 Wn 34 — *IStr* 104.8 *IA* 47.0 *IHs* 55.7 *IWsh* 24.3 — *CI* 84.6 *IF* 92.4.

32. Age 25, George Campbell. — St 1695 Str 1810 Sh 1412 A 767 Hs 915 Wsh 410 — Lh 188 Bh 161 Wf 154 Hf 123 Hn 52 Wn 37 — *IStr* 106.8 *IA* 45.4 *IHs* 54.1 *IWsh* 24.3 — *CI* 85.6 *IF* 79.9

33. Age 32, John. — St 1750 Str 1840 Sh 1445 A 780 Hs 905 Wsh 392 — Lh 204 Bh 161 Wf 162 Hf 134 Hn 58 Wn 40 — *IStr* 105.1 *IA* 44.6 *IHs* 51.7 *IWsh* 22.4 — *CI* 79.0 *IF* 82.7.
34. Age 33, Charley. — St 1682 Str 1700 Sh 1390 A 748 Hs 882 Wsh 352 — Lh 186 Bh 161 Wf 155 Hf 120 Hn 59 Wn 36 — *IStr* 101.1 *IA* 44.5 *IHs* 52.5 *IWsh* 21.0 — *CI* 86.6 *IF* 77.4.

II. *Females.*

35. Age 25, Lucy. — St 1650 Str 1620 Sh 1390 A 705 Hs 860 Wsh 327 — Lh 185 Bh 154 Wf 143 Hf 124 Hn 53 Wn 33 — *IStr* 98.2 *IA* 42.7 *IHs* 52.1 *IWsh* 19.8 — *CI* 83.2 *IF* 86.7.
36. Age 25, Mary. — St 1602 Str 1625 Sh 1332 A 685 Hs 817 Wsh 327 — Lh 180 Bh 146 Wf 139 Hf 111 Hn 50 Wn 27 — *IStr* 101.4 *IA* 42.8 *IHs* 51.1 *IWsh* 20.4 — *CI* 81.1 *IF* 79.9.

LOUCHEUX.

I. *Males.*

1. Age 21, Peter. — St 1570 Str 1630 Sh 1302 A 690 Hs 842 Wsh 355 — Lh 192 Bh 155 Wf 145 Hf 130 Hn 57 Wn 40 — *IStr* 103.8 *IA* 44.0 *IHs* 53.6 *IWsh* 22.6 — *CI* 80.7 *IF* 89.7.
2. Age 22, Samuel Simple. — St 1630 Str 1740 Sh 1360 A 753 Hs 830 Wsh 355 — Lh 192 Bh 156 Wf 145 Hf 118 Hn 52 Wn 38 — *IStr* 106.7 *IA* 46.2 *IHs* 51.0 *IWsh* 21.8 — *CI* 81.2 *IF* 81.4.
3. Age 22, Ike. — St 1690 Str 1720 Sh 1400 A 743 Hs 885 Wsh 375 — Lh 193 Bh 158 Wf 152 Hf 122 Hn 54 Wn 39 — *IStr* 101.8 *IA* 44.0 *IHs* 52.4 *IWsh* 22.2 — *CI* 81.9 *IF* 80.3. (Plate VII.)
4. Age 27, Enoch. — St 1705 Str 1760 Sh 1400 A 750 Hs 910 Wsh 365 — Lh 186 Bh 154 Wf 150 Hf 125 Hn 56 Wn 40 — *IStr* 103.2 *IA* 43.9 *IHs* 53.2 *IWsh* 21.3 — *CI* 82.8 *IF* 83.4.
5. Age 30, William. — St 1730 Str 1700 Sh 1422 A 752 Hs 940 Wsh 352 — Lh 197 Bh 148 Wf 147 Hf 123 Hn 56 Wn 35 — *IStr* 98.3 *IA* 43.5 *IHs* 54.3 *IWsh* 20.3 — *CI* 75.1 *IF* 83.7.
6. Age 33, Albert Jutely. — St 1690 Str 1830 Sh 1400 A 775 Hs 890 Wsh 387 — Lh 193 Bh 145 Wf 146 Hf 116 Hn 53 Wn 38 — *IStr* 108.3 *IA* 45.9 *IHs* 52.7 *IWsh* 22.9 — *CI* 75.1 *IF* 79.5.
7. Age 45, Peter Rose. — St 1622 Str 1715 Sh 1305 A 705 Hs 865 Wsh 395 — Lh 207 Bh 156 Wf 155 Hf 126 Hn 52 Wn 40 — *IStr* 105.7 *IA* 43.5 *IHs* 53.4 *IWsh* 24.4 — *CI* 75.4 *IF* 81.3.

II. *Females.*

8. Age 35, Mrs. McDonald. — St 1537 Str 1660 Sh 1322 A 727 Hs 807 Wsh 330 — Lh 185 Bh 156 Wf 144 Hf 120 Hn 51 Wn 35 — *IStr* 108.0 *IA* 47.2 *IHs* 52.4 *IWsh* 21.4 — *CI* 84.3 *IF* 83.3.

LOUCHEUX HALF-BLOODS.

I. *Males.*

9. Age 21, Johnie Stuart. — St 1530 Str 1655 Sh 1260 A 710 Hs 810 Wsh 340 — Lh 182 Bh 149 Wf 144 Hf 123 Hn 48 Wn 35 — *IStr* 108.2 *IA* 46.4 *IHs* 53.0 *IWsh* 22.2 — *CI* 81.9 *IF* 85.4.

II. *Females.*

10. Age 13, Mary McDonald. — St 1515 Str 1557 Sh 1252 A 697 Hs 772 Wsh 310 — Lh 180 Bh 146 Wf 140 Hf 105 Hn 48 Wn 30 — *IStr* 102.8 *IA* 45.9 *IHs* 50.8 *IWsh* 20.4 — *CI* 81.1 *IF* 75.0.

NUNATAGMIUT.

I. *Males.*

1. Age 14, Tagakarook. — St 1485 Str 1430 Sh 1227 A 620 Hs 757 Wsh 310 — Lh 176 Bh 152 Wf 136 Hf 115 Hn 51 Wn 32 — *IStr* 96.6 *IA* 41.9 *IHs* 51.1 *IWsh* 20.9 — *CI* 86.4 *IF* 84.6.
2. Age 14, Tooraruk. — St 1452 Str 1450 Sh 1180 A 628 Hs 787 Wsh 335 — Lh 176 Bh 145 Wf 136 Hf 118 Hn 51 Wn 32 — *IStr* 99.8 *IA* 43.3 *IHs* 54.3 *IWsh* 23.1 — *CI* 82.4 *IF* 86.8.
3. Age 19, Okpik. — St 1650 Str 1670 Sh 1382 A 722 Hs 817 Wsh 320 — Lh 183 Bh 151 Wf 142 Hf 124 Hn 56 Wn 34 — *IStr* 101.2 *IA* 43.8 *IHs* 49.5 *IWsh* 19.4 — *CI* 82.5 *IF* 87.3.
4. Age 20, Cheerok. — St 1700 Str 1780 Sh 1395 A 763 Hs 850 Wsh 390 — Lh 183 Bh 154 Wf 154 Hf 122 Hn 55 Wn 39 — *IStr* 104.7 *IA* 44.9 *IHs* 50.1 *IWsh* 22.9 — *CI* 84.2 *IF* 79.2.
5. Age 22, Nugaheenyuk. — St 1650 Str 1705 Sh 1375 A 735 Hs 870 Wsh 350 — Lh 183 Bh 145 Wf 144 Hf 125 Hn 56 Wn 38 — *IStr* 103.3 *IA* 44.5 *IHs* 52.7 *IWsh* 21.2 — *CI* 79.2 *IF* 86.8.
6. Age 24, Ouik. — St 1730 Str 1762 Sh 1430 A 730 Hs 902 Wsh 380 — Lh 189 Bh 165 Wf 152 Hf 132 Hn 56 Wn 31 — *IStr* 101.9 *IA* 42.2 *IHs* 52.1 *IWsh* 22.0 — *CI* 87.3 *IF* 86.8.
7. Age 30, Kunik. — St 1615 Str 1695 Sh 1385 A 720 Hs 852 Wsh 385 — Lh 186 Bh 154 Wf 157 Hf 115 Hn 49 Wn 41 — *IStr* 105.0 *IA* 44.7 *IHs* 52.9 *IWsh* 23.9 — *CI* 82.8 *IF* 73.2.
8. Age 35, Kagiktuk. — St 1655 Str 1720 Sh 1370 A 735 Hs 890 Wsh 395 — Lh 189 Bh 156 Wf 159 Hf 128 Hn 60 Wn 36 — *IStr* 104.0 *IA* 44.3 *IHs* 53.6 *IWsh* 23.8 — *CI* 82.5 *IF* 80.5.
9. Age 36, Kop Kana. — St 1672 Str 1710 Sh 1405 A 740 Hs 825 Wsh 392 — Lh 199 Bh 156 Wf 155 Hf 131 Hn 54 Wn 39 — *IStr* 102.3 *IA* 44.3 *IHs* 59.4 *IWsh* 23.5 — *CI* 78.4 *IF* 84.5.
10. Age 38, Nughuk. — St 1700 Str 1730 Sh 1405 A 755 Hs 900 Wsh 382 — Lh 186 Bh 153 Wf 158 Hf 122 Hn 58 Wn 34 — *IStr* 101.8 *IA* 44.4 *IHs* 52.9 *IWsh* 22.5 — *CI* 82.3 *IF* 77.2.

11. Age 40, Nowreuk. — St 1630 Str 1690 Sh 1360 A 710 Hs 840 Wsh 340 — Lh 197 Bh 159 Wf 153 Hf 132 Hn 59 Wn 36 — *IStr* 103.7 *IA* 43.6 *IHs* 51.5 *IWsh* 20.9 — *CI* 80.7 *IF* 86.3.
12. Age 44, Neuk. — St 1725 Str 1790 Sh 1430 A 770 Hs 885 Wsh 412 — Lh 199 Bh 152 Wf 162 Hf 141 Hn 60 Wn 41 — *IStr* 103.8 *IA* 44.8 *IHs* 51.5 *IWsh* 24.0 — *CI* 76.4 *IF* 87.0.
13. Age 45, Tooruk. — St 1740 Str 1740 Sh 1450 A 750 Hs 887 Wsh 367 — Lh 182 Bh 153 Wf 164 Hf 133 Hn 56 Wn 37 — *IStr* 100.0 *IA* 43.1 *IHs* 51.0 *IWsh* 21.1 — *CI* 84.1 *IF* 81.1.
14. Age 50, Edgillik. — St 1660 Str 1710 Sh 1370 A 725 Hs 855 Wsh 390 — Lh 186 Bh 153 Wf 155 Hf 131 Hn 56 Wn 42 — *IStr* 103.0 *IA* 43.7 *IHs* 51.5 *IWsh* 23.5 — *CI* 82.3 *IF* 84.5.
15. Age 60, Anatlook (Jags). — St 1742 Str 1720 Sh 1450 A 755 Hs 915 Wsh 375 — Lh 191 Bh 147 Wf 150 Hf 125 Hn 56 Wn 39 — *IStr* 98.9 *IA* 43.4 *IHs* 52.6 *IWsh* 21.6 — *CI* 77.0 *IF* 83.3.

II. *Females.*

16. Age 27, Kappak. — St 1590 Str 1600 Sh 1325 A 685 Hs 825 Wsh 330 — Lh 186 Bh 138 Wf 136 Hf 125 Hn 51 Wn 29 — *IStr* 100.6 *IA* 43.1 *IHs* 51.9 *IWsh* 20.8 — *CI* 74.2 *IF* 91.9.
17. Age 33, Iloonuk. — St 1550 Str 1560 Sh 1280 A 630 Hs 820 Wsh 365 — Lh 178 Bh 155 Wf 155 Hf 115 Hn 50 Wn 33 — *IStr* 100.6 *IA* 40.6 *IHs* 52.9 *IWsh* 23.5 — *CI* 87.1 *IF* 74.2.
18. Age 33, Pa nuchuk. — St 1535 Str 1500 Sh 1275 A 640 Hs 815 Wsh 325 — Lh 176 Bh 135 Wf 142 Hf 113 Hn 52 Wn 36 — *IStr* 97.4 *IA* 41.6 *IHs* 52.9 *IWsh* 21.1 — *CI* 76.7 *IF* 79.6.
19. Age 35, Atakok. — St 1480 Str 1540 Sh 1202 A 642 Hs 785 Wsh 320 — Lh 179 Bh 140 Wf 147 Hf 122 Hn 57 Wn 37 — *IStr* 104.1 *IA* 43.4 *IHs* 53.1 *IWsh* 21.6 — *CI* 78.2 *IF* 83.0.
20. Age 35, Kayak. — St 1620 Str 1760 Sh 1342 A 712 Hs 835 Wsh 375 — Lh 186 Bh 145 Wf 143 Hf 124 Hn 55 Wn 32 — *IStr* 108.6 *IA* 44.0 *IHs* 51.5 *IWsh* 23.1 — *CI* 78.0 *IF* 86.7.

Koukpagmiut.

I. *Males.*

1. Age 15, Cheechuk. — St 1565 Str 1585 Sh 1285 A 690 Hs 840 Wsh 350 — Lh 196 Bh 137 Wf 145 Hf 120 Hn 57 Wn 36 — *IStr* 101.3 *IA* 44.2 *IHs* 53.8 *IWsh* 22.4 — *CI* 69.9 *IF* 82.8.
2. Age 17, Napuktuna. — St 1605 Str 1540 Sh 1340 A 728 Hs 820 Wsh 335 — Lh 189 Bh 140 Wf 134 Hf 126 Hn 55 Wn 36 — *IStr* 96.3 *IA* 45.5 *IHs* 51.3 *IWsh* 20.9 — *CI* 74.1 *IF* 94.0.
3. Age 20, Kaatooak. — St 1725 Str 1700 Sh 1395 A 705 Hs 932 Wsh 410 — Lh 202 Bh 150 Wf 148 Hf 134 Hn 54 Wn 35 — *IStr* 98.2 *IA* 40.8 *IHs* 53.9 *IWsh* 23.7 — *CI* 76.7 *IF* 90.5.

4. Age 38, Noolookonua. — St 1615 Str 1655 Sh 1360 A 750 Hs 870 Wsh 360 — Lh 192 Bh 137 Wf 143 Hf 120 Hn 55 Wn 37 — *IStr* 102.5 *IA* 46.3 *IHs* 53.7 *IWsh* 22.2 — *CI* 71.4 *IF* 83.9.
5. Age 38, Pokik. — St 1595 Str 1690 Sh 1300 A 710 Hs 850 Wsh 380 — Lh 203 Bh 147 Wf 156 Hf 132 Hn 60 Wn 40 — *IStr* 105.9 *IA* 44.4 *IHs* 53.1 *IWsh* 23.8 — *CI* 72.4 *IF* 84.6.
6. Age 39, Kooattook. — St 1687 Str 1680 Sh 1400 A 735 Hs 925 Wsh 390 — Lh 192 Bh 150 Wf 146 Hf 120 Hn 52 Wn 36 — *IStr* 99.4 *IA* 43.5 *IHs* 54.7 *IWsh* 23.1 — *CI* 78.1 *IF* 82.2.
7. Age 40, Takutsakin. — St 1740 Str 1830 Sh 1465 A 805 Hs 912 Wsh 380 — Lh 197 Bh 144 Wf 151 Hf 131 Hn 59 Wn 37 — *IStr* 105.2 *IA* 46.3 *IHs* 52.4 *IWsh* 21.8 — *CI* 73.1 *IF* 86.8.
8. Age 40, Ok Kowyak. — St 1700 Str 1800 Sh 1450 A 765 Hs 902 Wsh 412 — Lh 200 Bh 141 Wf 154 Hf 141 Hn 61 Wn 39 — *IStr* 105.9 *IA* 45.0 *IHs* 53.1 *IWsh* 24.2 — *CI* 70.5 *IF* 91.6.
9. Age 40, Koloochook. — St 1650 Str 1680 Sh 1335 A 700 Hs 922 Wsh 370 — Lh 189 Bh 138 Wf 143 Hf 143 Hn 61 Wn 40 — *IStr* 101.8 *IA* 42.4 *IHs* 55.9 *IWsh* 22.4 — *CI* 73.0 *IF* 100.0.
10. Age 40, Kaiyoon. — St 1645 Str 1650 Sh 1342 A 722 Hs 860 Wsh 375 — Lh 193 Bh 144 Wf 149 Hf 126 Hn 50 Wn 41 — *IStr* 100.3 *IA* 44.0 *IHs* 52.4 *IWsh* 22.9 — *CI* 74.6 *IF* 84.6.
11. Age 41, Osliyook. — St 1640 Str 1680 Sh 1335 A 710 Hs 892 Wsh 400 — Lh 191 Bh 148 Wf 147 Hf 123 Hn 52 Wn 42 — *IStr* 102.4 *IA* 43.3 *IHs* 54.4 *IWsh* 24.4 — *CI* 77.5 *IF* 83.7.
12. Age 43, Toguktoo. — St 1795 Str 1802 Sh 1515 A 768 Hs 932 Wsh 400 — Lh 193 Bh 146 Wf 155 Hf 136 Hn 59 Wn 38 — *IStr* 100.4 *IA* 42.9 *IHs* 52.1 *IWsh* 22.3 — *CI* 75.6 *IF* 87.7.
13. Age 50, Killaakilook. — St 1702 Str 1765 Sh 1432 A 772 Hs 937 Wsh 400 — Lh 199 Bh 148 Wf 147 Hf 143 Hn 63 Wn 38 — *IStr* 103.7 *IA* 45.4 *IHs* 55.1 *IWsh* 23.5 — *CI* 74.4 *IF* 97.3.
14. Age 52, Maakilook. — St 1600 Str – Sh 1320 A 733 Hs 837 Wsh 340 — Lh 192 Bh 135 Wf 137 Hf 129 Hn 57 Wn 40 — *IStr* – *IA* 45.8 *IHs* 52.3 *IWsh* 21.3 — *CI* 70.3 *IF* 94.2.

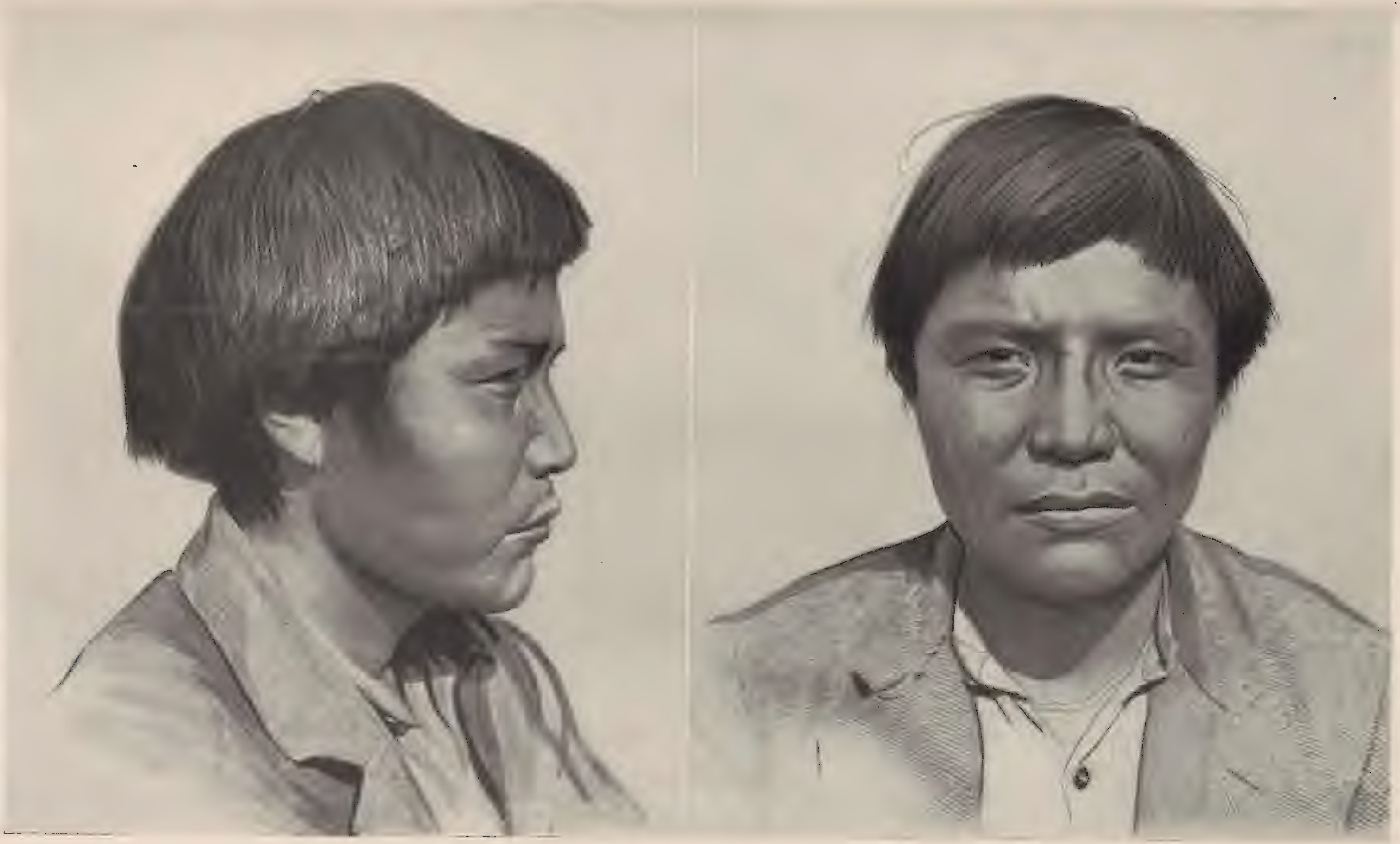
II. *Females.*

15. Age 23, Taabuts. — St 1497 Str 1480 Sh 1205 A 620 Hs 797 Wsh 345 — Lh 186 Bh 138 Wf 135 Hf 117 Hn 51 Wn 31 — *IStr* 98.7 *IA* 41.3 *IHs* 53.1 *IWsh* 23.0 — *CI* 74.2 *IF* 86.7.
16. Age 33, Illookotchulook. — St 1470 Str 1480 Sh 1190 A 650 Hs 790 Wsh 330 — Lh 191 Bh 140 Wf 134 Hf 118 Hn 52 Wn 33 — *IStr* 100.7 *IA* 44.2 *IHs* 53.7 *IWsh* 22.4 — *CI* 73.3 *IF* 88.1.
17. Age 37, Ikowik. — St 1550 Str 1520 Sh 1265 A 645 Hs 845 Wsh 330 — Lh 184 Bh 142 Wf 146 Hf 119 Hn 47 Wn 34 — *IStr* 98.1 *IA* 41.6 *IHs* 54.5 *IWsh* 21.3 — *CI* 77.2 *IF* 81.5.

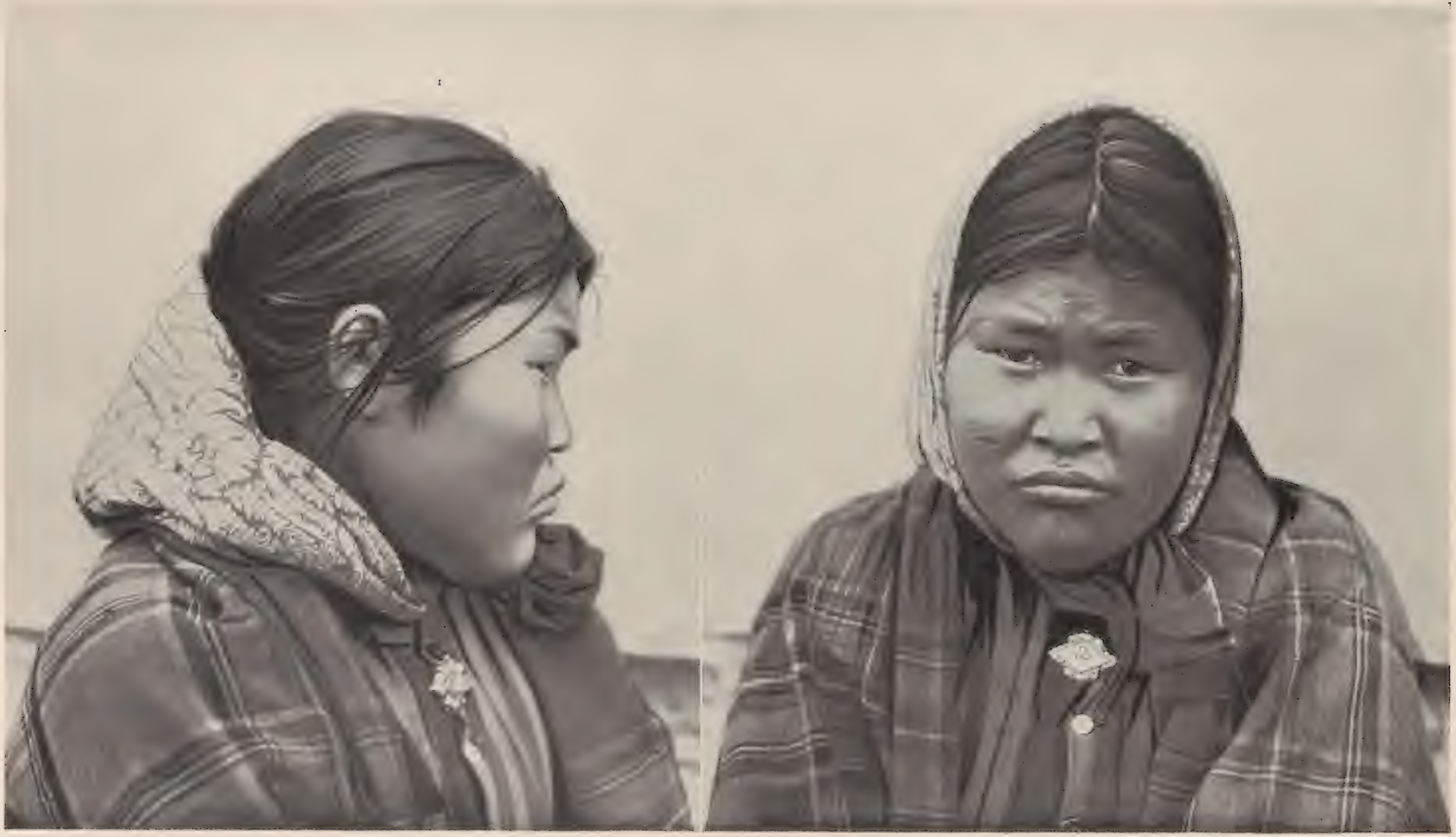
18. Age 37, Kopkwoono. — St 1480 Str 1490 Sh 1205 A 623 Hs 780 Wsh 340 — Lh 183 Bh 140 Wf 141 Hf 126 Hn 56 Wn 33 — *IStr* 100.7 *IA* 42.1 *IHs* 52.7 *IWsh* 23.0 — *CI* 76.5 *IF* 89.4.

19. Age 40, Aanoppiyook. — St 1560 Str 1555 Sh 1260 A 643 Hs 840 Wsh 370 — Lh 196 Bh 138 Wf 136 Hf 123 Hn 52 Wn 32 — *IStr* 99.7 *IA* 41.2 *IHs* 53.8 *IWsh* 23.7 — *CI* 70.4 *IF* 90.4.

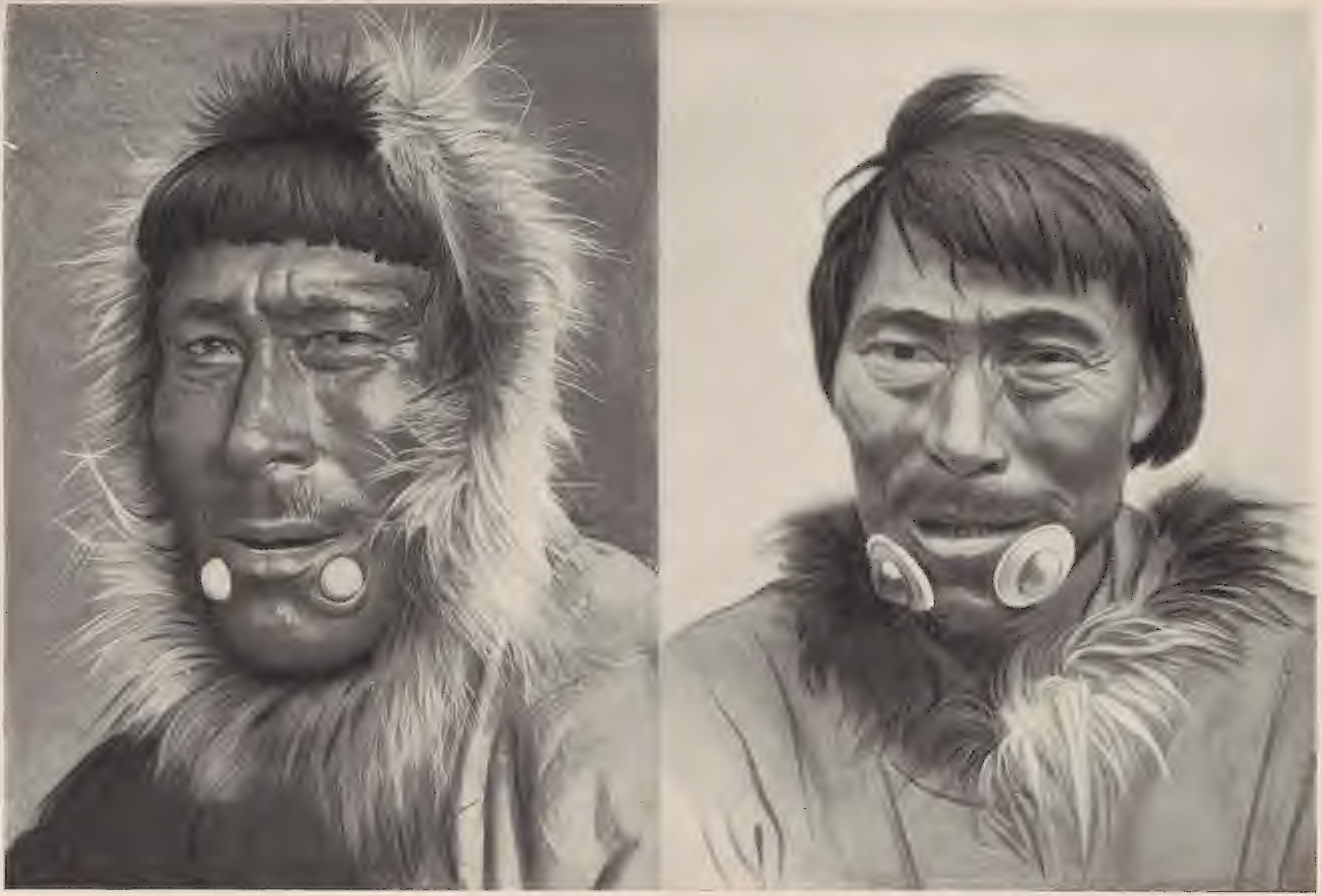
20. Age 43, Igonua. — St 1532 Str 1560 Sh 1250 A 700 Hs 820 Wsh 310 — Lh 187 Bh 151 Wf 146 Hf 122 Hn 59 Wn 36 — *IStr* 101.8 *IA* 45.8 *IHs* 53.6 *IWsh* 20.3 — *CI* 80.7 *IF* 83.6.



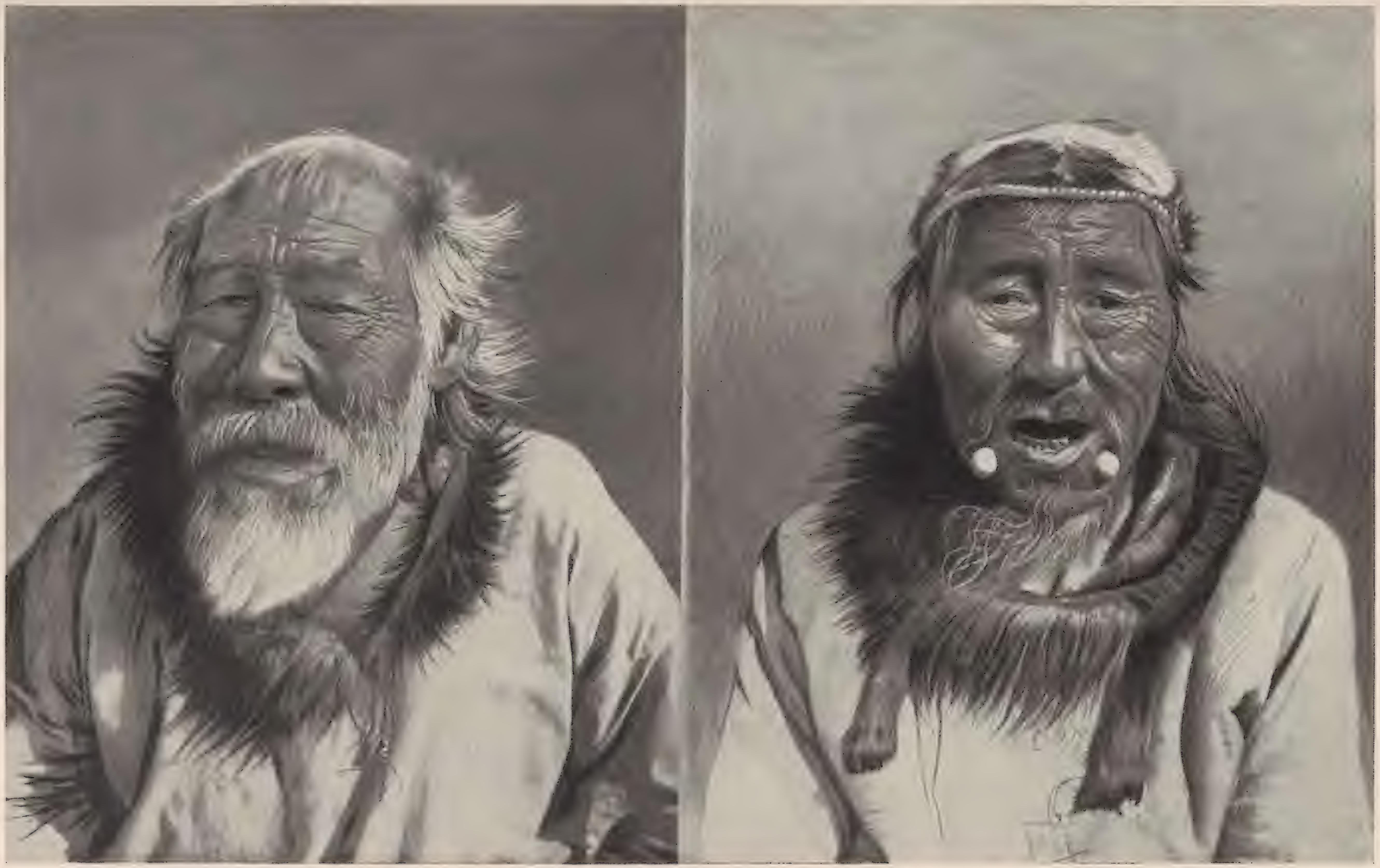
LOUCHEUX MAN.



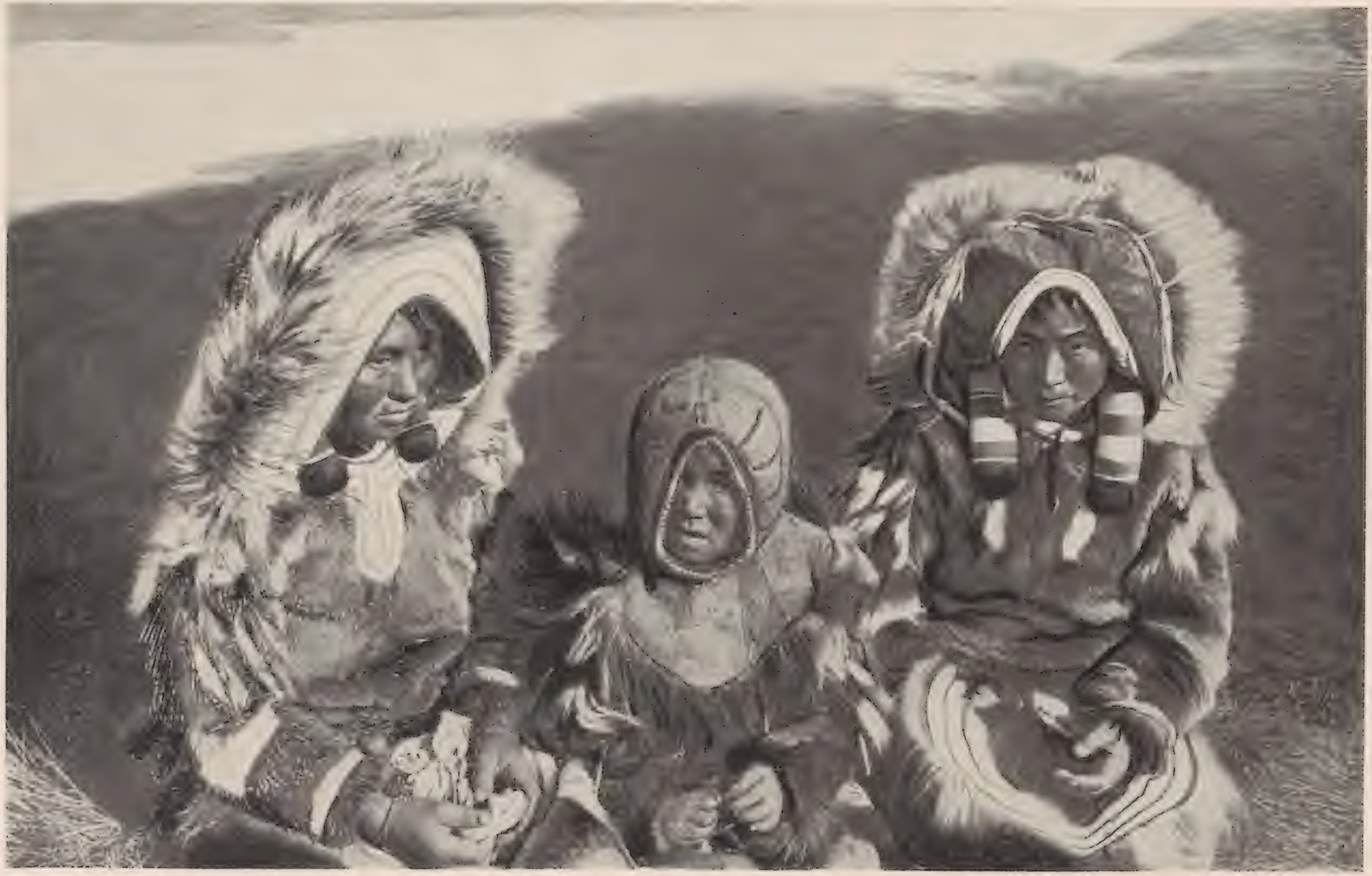
LOUCHEUX WOMAN.



Koukpagmiut Men.



KOUKPAGMIUT MEN.



Koukpagmiut Women and Child.

Article VII. — THE MUSK-OXEN OF ARCTIC AMERICA AND GREENLAND.

By J. A. Allen.

Plates XII–XVII, and 7 Text Figures.

A fine series of Musk-Oxen, collected by Lieut. R. E. Peary, U. S. N., on Bache Peninsula, October 7, 1898, and recently received at the Museum through the Peary Arctic Club, has furnished opportunity for comparison of the coast form with the Musk-Oxen of the Barren Grounds east of the Mackenzie River, and with others alleged to have come from the barren grounds of Alaska, west of the Mackenzie.

Respecting these specimens, the following extract from a letter from Mr. Peary to the President of the Peary Arctic Club, dated "Etah, Greenland, Aug. 28, 1899," will be of interest:

> " . . . . I send you skins and skulls of Musk-Oxen killed on Bache Peninsula in October, 1898, with skulls of eight others, killed in the same place. I regret that there are no measurements of these animals. I have been unfortunate in not being present at the killing of any of the animals. Fifteen, comprising all of one herd, were killed on the afternoon of Oct. 7, when the days were very short; and what with the cold and darkness and the necessity for skinning the animals with the utmost speed before they became frozen and before the meat was tainted, seven of the skins were spoiled as specimens, and the corresponding leg bones of the other eight were not noted by the Eskimos and were not possible of identification when I reached the place the next day.
>
> "Also skin and skull of another (a bull) killed in the same locality April 14, and the skin and skull of a calf killed by Dr. Dedrick at Fort Conger and brought in by him intact so that I was able to get measurements."

This material proved on examination to consist of ten skins with skulls, one skin (of a yearling) without skull, one head of an old bull, and seven additional skulls without skins, representing in all nineteen individuals. The skins comprise two adult females and a female calf, three old males, and five young males of different ages. Five of the skins have been selected to mount for a group, with the proper accessories. The mounting of the animals is so nearly completed that it is practicable to give photographs of them in the present connection, as well as photographs of mounted specimens from the Barren Grounds.

For comparison with the Peary material the Museum has three mounted specimens,— two adult males and an adult female, — an unmounted adult male, and two calves a few weeks old, from the Barren Grounds east of the Mackenzie, but without data as to exact locality. For opportunity to examine also three Alaska specimens,— two old males and an old female, — said to have been taken a few miles inland from Camden Bay, I am indebted to the kindness of Mr. Hubert H. Vogelsang, taxidermist, of New York City.

As regards both skins and skulls, it has thus been possible to compare the nineteen Peary specimens from Bache Peninsula with nine specimens from the Barren Grounds. This comparison has resulted in the rather surprising discovery that the Musk-Oxen of the insular lands west of Kane Basin differ very markedly from those of the Barren Grounds to the westward, not only in coloration but in shape and relative size of the basal portion of the horns. As *Ovibos moschatus* (Zimmermann) was based exclusively on the Barren Ground form (the type locality being the Churchill River region), it seemed fitting to name the new coast form in honor of the intrepid Arctic explorer, Lieut. R. E. Peary, U. S. N., to whose labors in the high North the Museum is indebted for a large amount of valuable material in various lines of research. Since adopting this name in my manuscript, however, Mr. R. Lydekker, of the British Museum, has named the East Greenland Musk-Ox *Ovibos moschatus wardi*, taking for his types a mounted male and female from East Greenland, in the possession of Mr. Rowland Ward, the well-known natural history dealer of Piccadilly, London, for whom the species is named. (See Nature, Vol. LXIII, p. 157, Dec. 13, 1900.)

Although the Peary specimens came from Bache Peninsula, on the western side of Kane Basin, they probably are referable to the Greenland form, and I hence adopt for them Mr. Lydekker's name, citing "*Ovibos pearyi* Allen, MS.," as a provisional synonym, which may be accepted for the Grinnell Land animal in case it should prove separable. On geographical and other grounds, this appears hardly probable, as the Musk-Ox of this region seems to have a practically continuous distribution on the American side from the southern part of Ellesmere Land (about Lat. 78°) northward to the Polar Sea, and on the Greenland side, from Melville Bay (about Lat. 75°) northward, eastward, and southward along the east coast to King William Land in about latitude 74° 30′. It seems probable, as stated by Greely (Three Years of Arctic Service, Vol. II, 1886, p. 361), that the Musk-Ox may have reached Greenland from the west at two points, namely by crossing Smith Sound from Ellesmere Land, and also by crossing Robeson Channel from Grinnell Land, thence finding easy passage along the low Greenland coast to East Greenland.

As very few details have been published regarding the external characters of the East Greenland Musk-Ox,[1] and none in regard to the Ellesmere Land form, it seems desirable to utilize the present materials as a contribution to the subject.

Ovibos wardi (*Lydekker*).

PEARY'S MUSK-OX.

Ovibos moschatus wardi LYDEKKER, Nature, LXIII, p. 157, Dec. 13, 1900.
Ovibos pearyi ALLEN, MS.

General coloration, including horns, lighter than in *O. moschatus*, with a white or whitish face-spot, and the ears and whole front of the head more or less gray, instead of wholly dark brown as in *O. moschatus;* basal portion of the horns much narrower and of different shape from those of *O. moschatus.*

Adult Male.—Above with a 'saddle-mark' of light brown or whitish brown on the middle of the back, varying somewhat in degree of lightness, size, and shape in different individuals; rest of the body dark brown, lighter and more rufous brown on the shoulders; a white area on the front of the head, forming a broad face-spot; ears and a rather broad, not well-defined patch below the ears, spreading forward on the sides of the head, gray; the rest of the head, where not white, whitish, or grayish white, is more or less grizzled through the admixture of white hairs; whole nose white or whitish, the white of the nose separated from the white of the forehead by a darker band half way between forehead and nose; feet white or whitish from the hoofs upward to or a little beyond the carpal and tarsal joints, including nearly all of the portion of the limbs not concealed by the long shaggy coat of the body, becoming darker proximally so that the white of the feet rather gradually merges into the darker color of the upper segments of the limbs. The white on the head in old males often forms a white band behind the horns; in others it is partly in front of them and partly behind them, or entirely in front of them.

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[1] Its soft anatomy has been recently described by Dr. Einar Lönnberg ('On the Soft Anatomy of the Musk-Ox (*Ovibos moschatus*),' Proc. Zoöl. Soc. London, 1900, pp. 142–167, with 14 text figures), and the same author (*t. c.*, pp. 686–718, with 10 text cuts) has also given an account of the development of the horns, the character of the hoofs, and a detailed description of the skull, based on specimens obtained in East Greenland by the Swedish Expedition in 1899. Sir John Richardson's description of the osteology of the Musk-Ox, based on specimens from the Arctic Barren Grounds, in the 'Voyage of the Herald,' is well known.

Females and Young Males.—The females and young males are similar, as regards the light markings. The white on the head is somewhat variable in respect to purity and extent in different individuals; it is never wanting and averages about as above described.

Young.—A young female calf, probably not more than six weeks old, killed at Fort Conger May 18, 1899, is nearly black throughout, except for the grayish ears, whitish nose, dingy brown feet, and a lighter, brownish, incipient saddle-mark on the back, being much darker than the adult and half-grown specimens, and with only a trace of the white face-spot of the adults.

Measurements.—Unfortunately, as already explained, no measurements were taken from the animals before skinning. The following are from mounted specimens, and probably do not vary much from the true dimensions.[1] For comparison, perfectly comparable measurements (in millimeters) are given of three mounted specimens of *O. moschatus* from the Barren Grounds east of the Mackenzie River.

MEASUREMENTS OF MOUNTED SPECIMENS OF
Ovibos moschatus AND *O. wardi*.

	O. moschatus.			*O. wardi.*	
Museum Number.	326	10034	11986	15594	15591
Sex.	♂ ad.	♂ ad.	♀ ad.	♂ ad.	♀ ad.
Total length, nose to rump, along curvatures	2500	2400	2200	2540	2000
Total length, nose to rump, in straight line	2230	1980	1970	2045	1660
Length of head	575	620	450	500	420
Height at shoulder	1200	1280	1100	1230	980
" " hips	1150	1090	1000	1160	940
Length of hind foot	445	500	375	450	355
" " fore foot	338	335	285	295	290
" " ear	85	110	134	156	115
Width of hind foot	90	160	105	95	78
Length of one hoof, vertical	85	80	68	47	46
Width of fore foot	107	127	125	105	90
Length of one hoof, vertical	98	75	73	58	54

Skull.—The skull does not appear to differ materially in size or proportions from that of *O. moschatus*. But there is a marked difference in the size and form of the basal portion of the horns, as shown in the accompanying illustrations (Figs. 1–5). The greatest width (taken with calipers) at the extreme base is one fourth less in *O. wardi* than in *O. moschatus*, and at 100 mm. from the base, one sixth narrower, resulting in very different outlines for the basal portion of the horn in the two species. In length and curvature of the horns there is very little difference between the two forms. The apparent difference in the length of the horns of the two skulls photographed is due to the horns of the Bache Peninsula specimen being very much worn, as is commonly seen in the horns of old bull Bisons.

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[1] Mr. Peary's measurements of the calf killed at Fort Conger, May 18, 1899, are as follows: "Length over all, 3 feet 5 inches (1019 mm.); height at foreshoulder, 2 feet (610 mm.); girth of chest, 2 feet 3 in. (584 mm.); girth of abdomen, 2 feet 1 in. (511 mm.); girth of neck, 1 foot 3 in. (330 mm.). Eyes, black. Weight, 43 pounds."

In these illustrations the relative greater breadth of the base of the horns is strikingly indicated in the side view, where, in *O. moschatus*, the anterior extension of the base of the horn conceals the greater part of the left eye-socket, while in the Bache Peninsula specimen it does not hide even its posterior border. It will also be noted that the occipital portion of the skull is exposed, in both views, in *O. wardi*, and concealed in *O. moschatus*, by the expanded posterior base of the horns.

Figures 1–4 are from photographs, all made to the same scale. The two skulls here shown are both old males, in prime of life, the teeth being not greatly worn; the two specimens are strictly comparable as to age, as shown by the teeth and sutures of the skulls.

MEASUREMENTS OF SKULLS OF MALES OF
Ovibos moschatus AND *O. wardi*.

	O. moschatus.			*O. wardi.*		
	A	B	16604	15594	15593	15596
	♂[1]	♂[1]	♂[2]	♂[3]	♂[3]	♂[3]
Total length	500	515	480	510	476	480
Basal length	437	455	445	465	440	445
Palatal length	265	275	260	280	260	260
Length of nasals	154	158	?	160	148	155
Mastoid breadth	168	182	182	184	174	175
Interorbital breadth (at outer posterior border of eye-sockets)	265	—	250	263	220	225
Length of upper tooth-row	138	132	123	130	138	139
Width of palate opposite m′	77	75	80	82	80	77
Lower jaw, length from incisive border to posterior edge of condyle	370	—	—	385	370	374
Lower jaw, height	180	—	—	175	170	170
Length of lower tooth-row	145	—	—	130	140	141
Distance between tips of horns	620	675	583	495	630	540
Breadth of horn at base	235	230	250	165	167	213
“ “ “ 100 mm. from base	148	126	127	116	117	108
Length of horn measured along curvature of upper surface	650	565	575	490	560	530

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[1] A, and B, Camden Bay, Alaska. Both specimens are fully adult, but specimen B is a little older and larger than specimen A, the teeth in the latter being practically unworn, while in B the teeth are moderately worn.

[2] No. 16604 is from the Barren Grounds east of the Mackenzie River,— an adult male with the teeth moderately worn. The skull lacks the lower jaw.

[3] Nos. 15594, 15593, and 15596, from Bache Peninsula are all adult males, the teeth showing full maturity, being moderately worn in two of them; they are therefore strictly comparable with the specimens from the Barren Grounds.

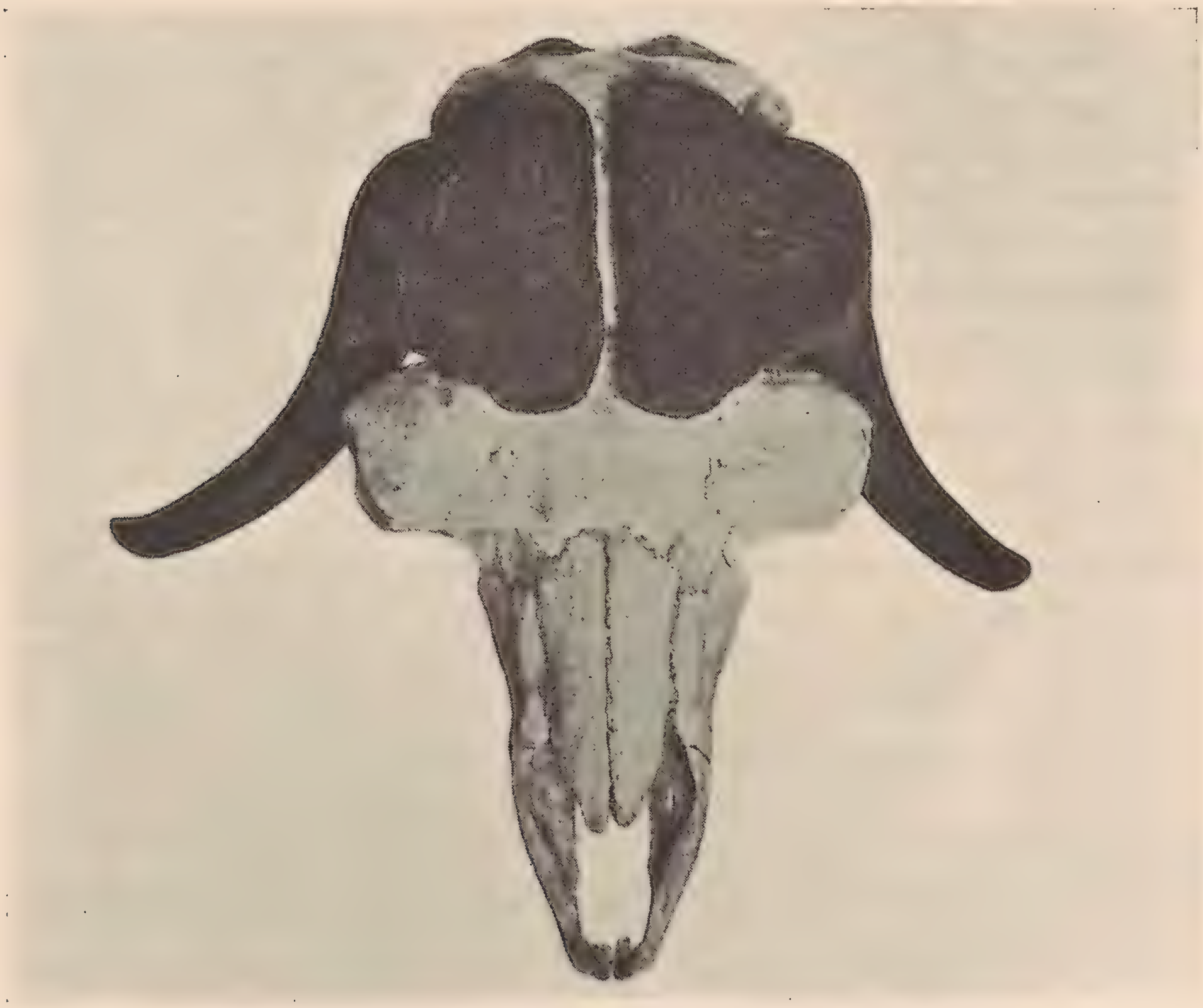

Fig. 1. *Ovibos wardi*, ♂ ad., No. 15594. Bache Peninsula.

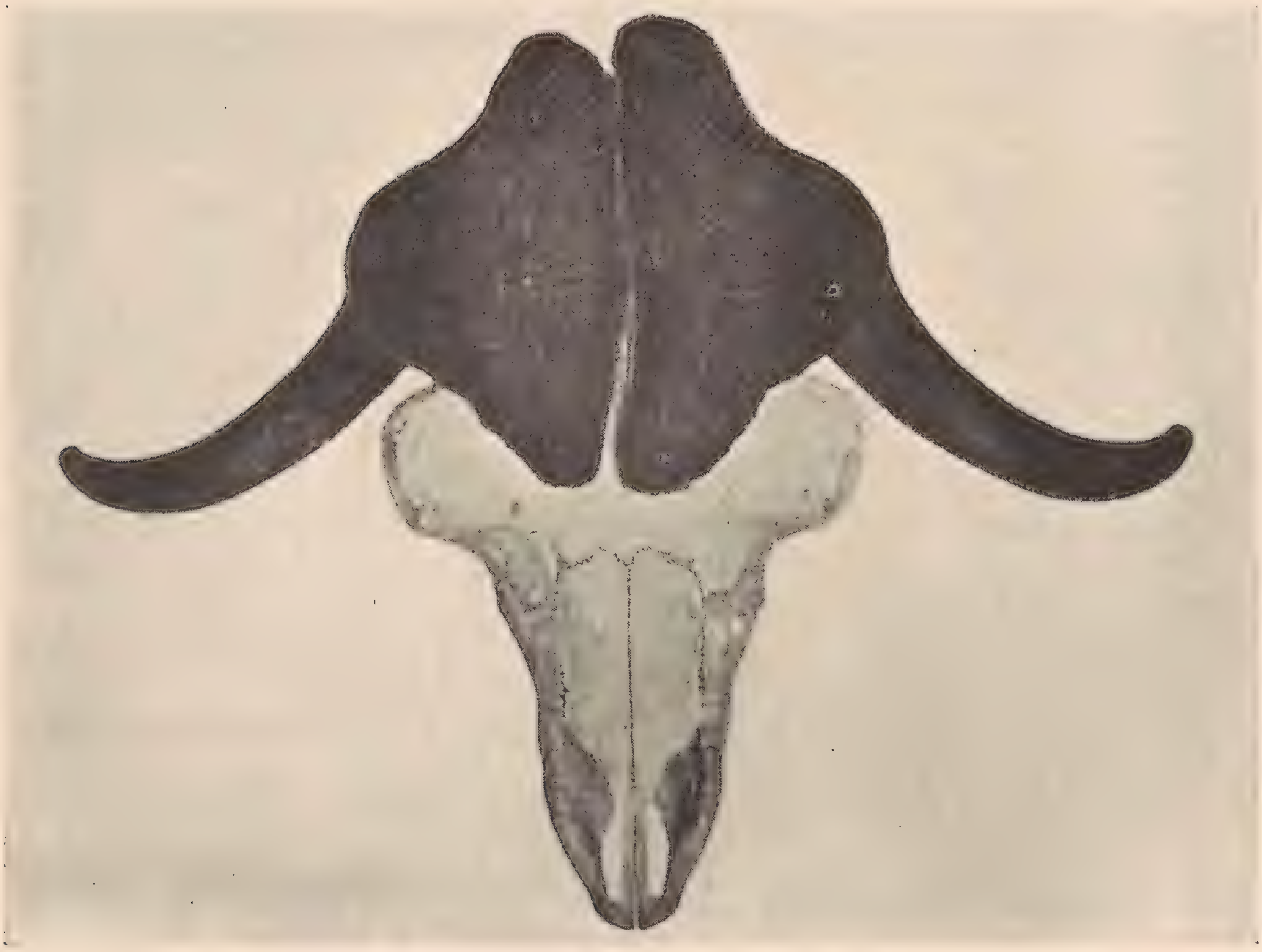

Fig. 2. *Ovibos moschatus*, ♂ ad., No. 16604. Arctic Barren Grounds.

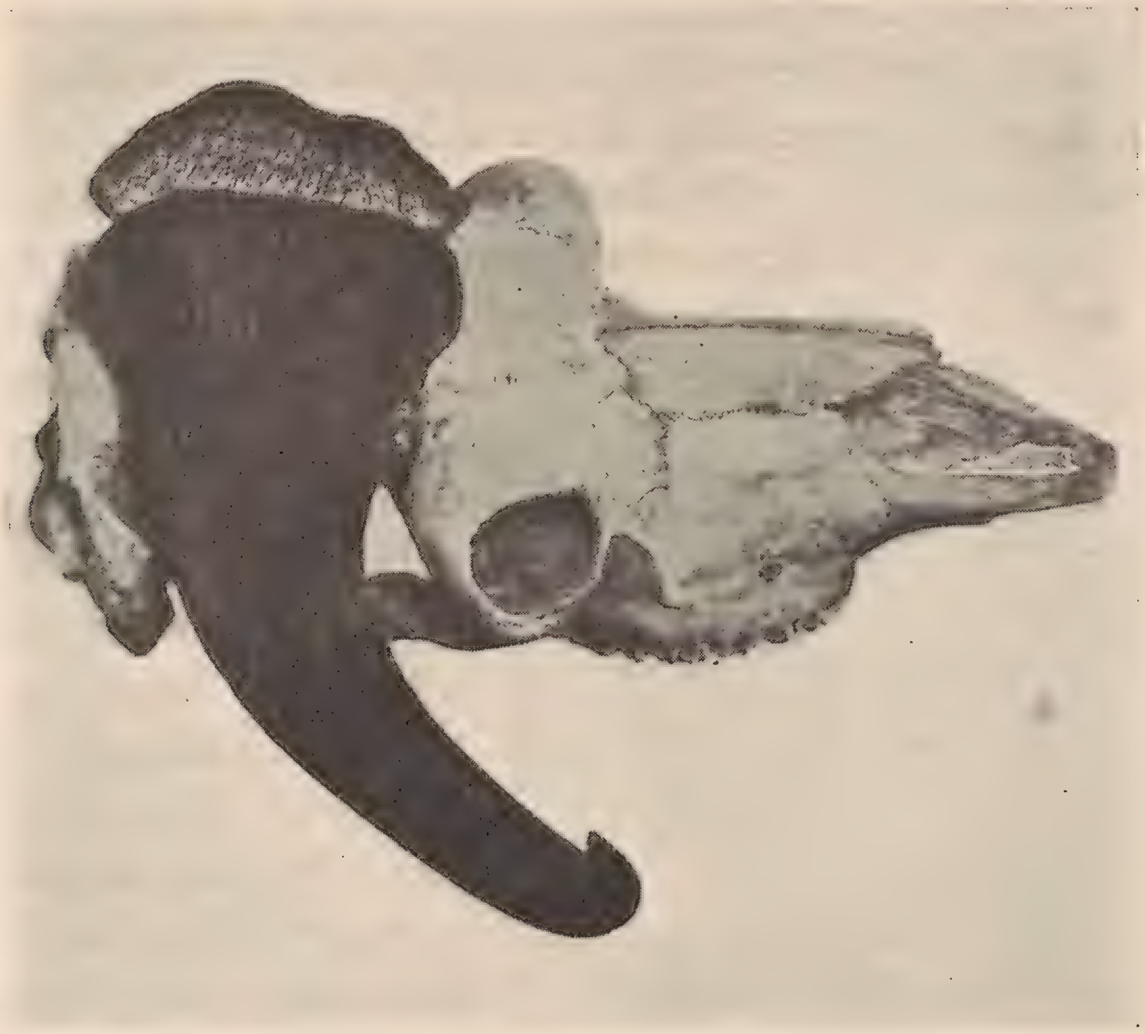

Fig. 3. *Ovibos wardi*, ♂ ad. Same specimen as shown in Fig. 1.

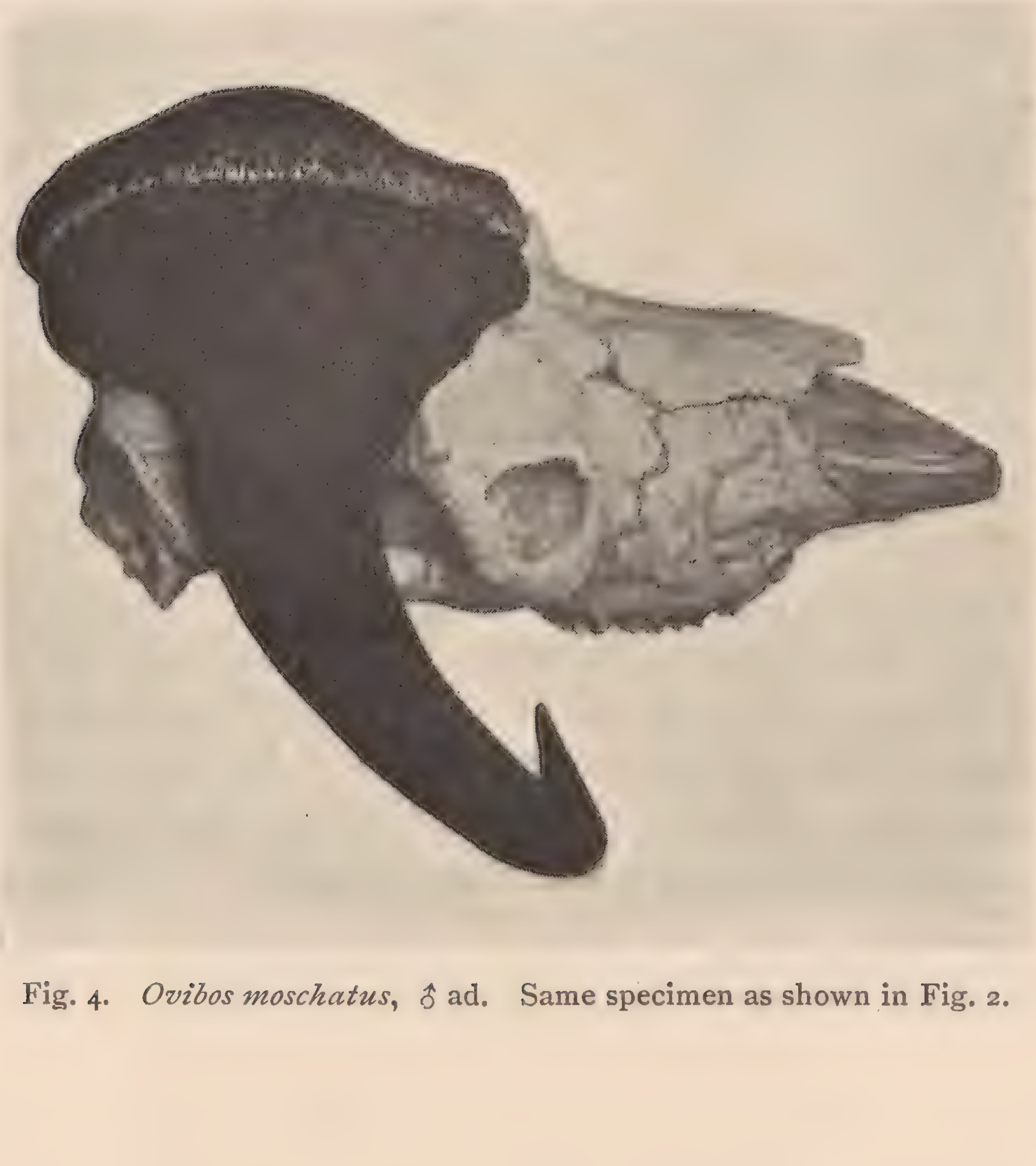

Fig. 4. *Ovibos moschatus*, ♂ ad. Same specimen as shown in Fig. 2.

In coloration *O. moschatus* differs from *O. wardi* in the generally darker color of the whole animal, including the horns as well as the pelage, but especially in the color of the head, which, except the muzzle, is wholly dark brown, without the white face-spot or any appreciable admixture of gray on the front and sides of the head or on the ears. (Plates XII–XVII.) In a single old female, out of six old males and two old females examined, there are a few gray hairs on the face, but they are not noticeable except on close inspection; on parting the hairs with the hand a sparse sprinkling of such hairs can be seen. The other seven show no white or gray on any part of the head or ears. The difference in the size and form of the basal portion of the horns is a further important differentiation of the two forms. (Figs. 1–5.) The hoofs also differ greatly in the two forms, as shown in the accompanying diagrams (Figs. 6 and 7) and in the table of measurements, the front of the hoof being much longer and more incurved in *O. moschatus* than in *O. wardi*.

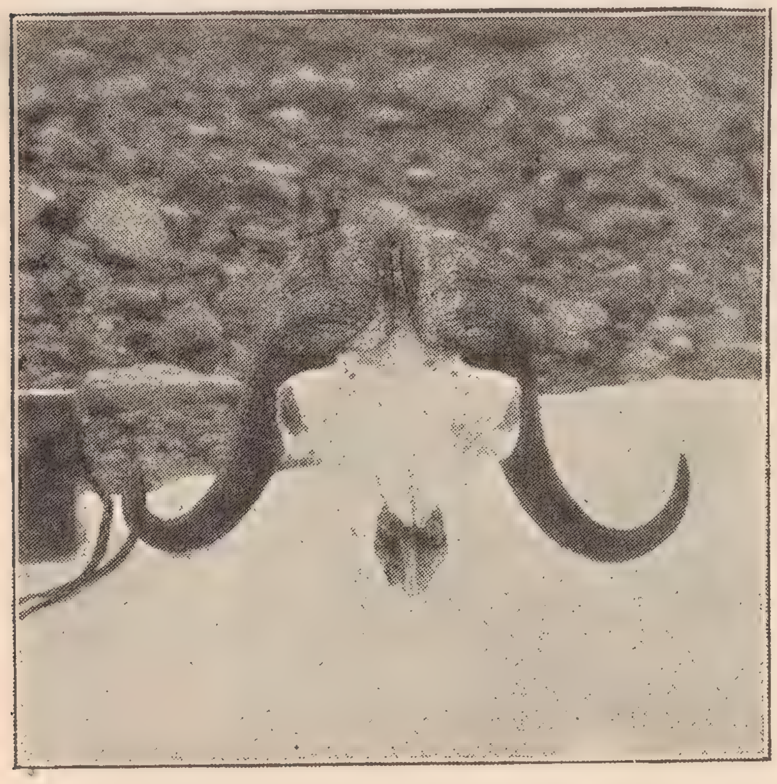

Fig. 5. *Ovibos wardi*, ♂ ad. Independence Bay, Greenland. 'Headpiece' from Peary's 'Northward over the Great Ice,' Vol. I, 1898, p. 329, through the kindness of the Frederick A. Stokes Company, publishers. The first illustration of the skull of *Ovibos wardi* ever published.

The geographical relations of the two are not clear, but it seems probable that *O. wardi* is the form inhabiting the numerous islands, more or less joined by ice in winter, situated east and north of Belcher Channel and Jones Sound, while *O. moschatus* is confined mainly to the Barren Grounds, with formerly, probably, continuous distribution westward across Alaska. The eastern limit of *O. moschatus* cannot at present be accurately defined. The Melville Island specimens obtained by Parry on his first voyage in 1820, evidently represent typically the Barren Ground form, as shown by Parry's and Gray's figures.[1] Whether or not it crosses eastward to the adjoining islands there is apparently no certain evidence, but much of a negative character indicating its absence. It can easily reach Melville Island from Banks Land. It has been found in numbers in the region between Repulse Bay and King William Land, but is absent from Southampton Island, and Fox Channel has apparently proved a barrier to its extension to Cockburn and Baffin Lands. As *O. wardi* has not been traced south of Ellesmere Land, nor west of Ellesmere Land and Grinnell Land, there is apparently a broad interval of insular areas and estuaries where no form of Musk-Ox at present exists, leaving the ranges of the two forms well separated. When Musk-Oxen ranged far to the southward of their present limits, they doubtless had a continuous distribution over a large part of northern North America, and have become differentiated in comparatively recent times through separation in their gradual retreat northward.

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[1] See Parry's First Voyage, 1821, p. 257, and plate xvii, facing p. 256. Also Gray, Cat. Mamm. in Brit. Mus., Part III, 1852, p. 43, and pl. v., figs. 1 and 2, giving two views of skull of an old male, collected by Parry on Melville Island.

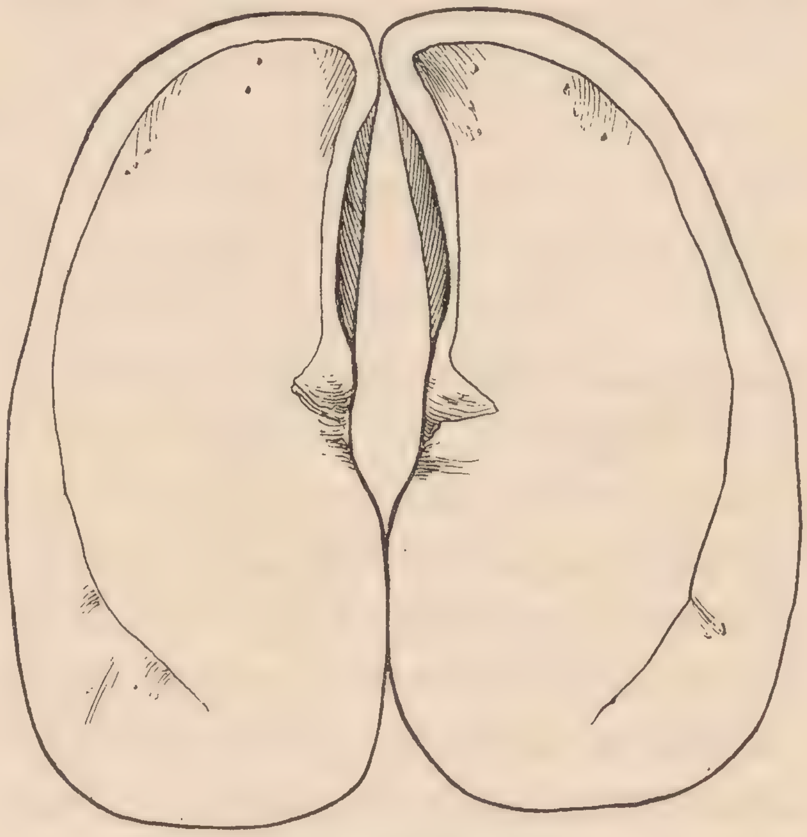

Fig. 6. Forefoot of *Ovibos wardi*, ½ natural size.

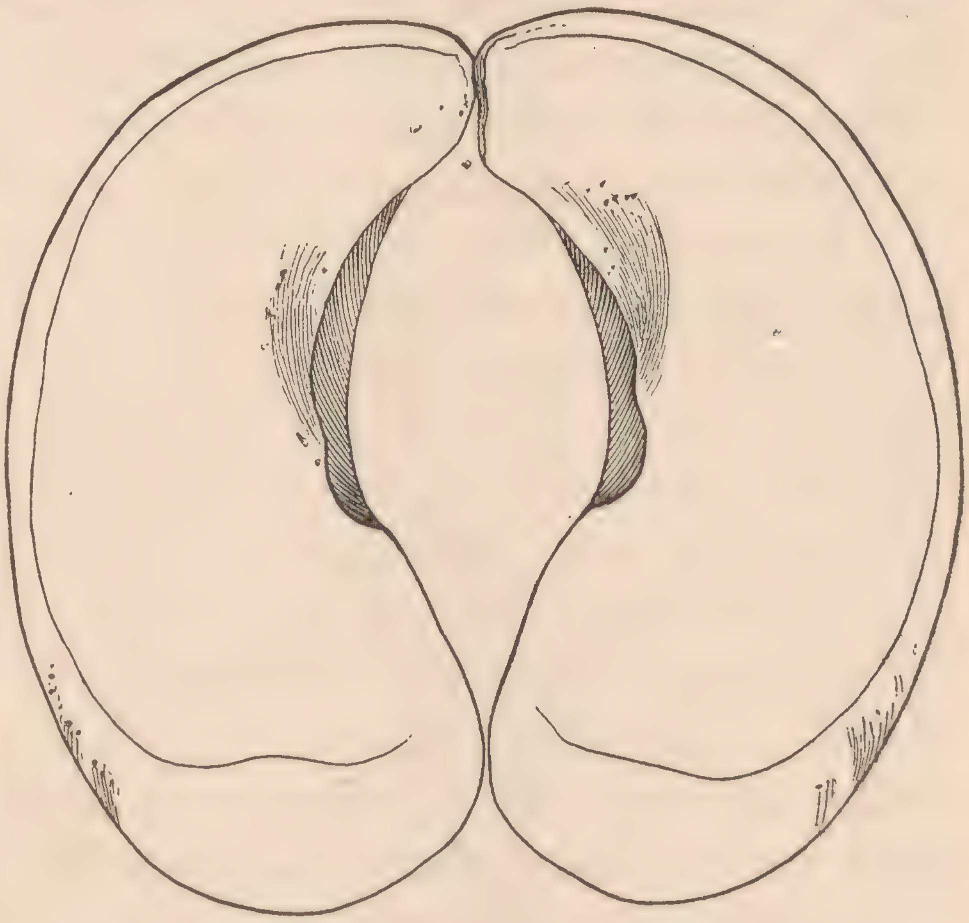

Fig. 7. Forefoot of *Ovibos moschatus*, ½ natural size.

The known range of *O. wardi* extends from the southern border of Ellesmere Land northward through Grinnell Land to the Polar Sea, and on the Greenland coast, either living or recently extinct, from about Lat. 78° on the western side northward to and around the northern end of Greenland to about latitude 75° N. on the east coast.

As early as 1853 Dr. Kane found recent remains of Musk-Oxen in the vicinity of Rensselaer Bay, west coast of Greenland, in latitude 78° 41′ N. (Arctic Expl., Vol. II, pp. 80 and 456), and later Dr. Hayes and subsequent explorers discovered similar remains near Foulke Fiord, somewhat further south (Lat. 78° 18′ N.). According to Kane, living animals were seen near Cape George Russell as late as the spring of 1850 (*l. c.*, p. 459), while Hayes reports (Voy. Towards the North Pole, 1886, p. 390) that two were seen and one killed by an Eskimo hunter near Wolstenholme Sound in the winter of 1859. In July, 1892, Peary killed Musk-Oxen in northernmost Greenland, at Independence Bay, and again at the same place in 1895, but beyond a 'headpiece', giving a very good front view of the skull (Northward over the Great Ice, I, 1898, p. 329), and reproductions of indistinct photographs, almost valueless as to details (*l. c.*, pp. 337 and 339), and some very good photographs of similar subjects taken in 1895 (*l. c.*, Vol. II, pp. 472, 475, 477), we have nothing tending to show their external features, either in text or figures. The figure of the skull in Vol. I (p. 329), here reproduced (Fig. 5), shows the form of the horns to be as in the Bache Peninsula specimens,[1] and the second series of pictures of dead Musk-Oxen (Vol. II, *l. c.*) illustrate admirably the white face-mark, which forms so distinctive a feature of the coloration. The picture of a wounded old bull (II, p. 472), gives a front view of the head, in which the white face-mark and the generally light color of the head are admirably shown. This is supplemented by a side view (*l. c.*, 473), and a view of a dead Musk-Ox lying on its right side, giving a clear view of the dorsal aspect of the whole animal, both of which show the same feature. There is also (*l. c.*, p. 486) a view in profile of a living Musk-calf.[2] While no specimens from northeast Greenland are available for examination, these illustrations render it certain that the Independence Bay Musk-Oxen closely resemble the Musk-Oxen of Bache Peninsula.

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[1] Compare Schwatka's figures of the Barren Ground Musk-Oxen in his 'A Nimrod in the North' (1885), plate facing p. 105.

[2] Through the kindness of the Frederick A. Stokes Company of New York City, publishers of Mr. Peary's 'Northward over the "Great Ice,"' I am able to here reproduce four of Mr. Peary's illustrations (see Fig. 5 and Plates XVI and XVII).

The Nares Expedition found numerous recent traces of Musk-Oxen on the northern shore of Ellesmere Land, just south of Bache Peninsula, in 1875, and living Musk-Oxen at various points along the eastern coast of Grinnell Land (Narr. Voy. to the Polar Sea, Vols. I and II, 1878, *passim*, and Vol. II, pp. 198–202—a summary by Lieut. Feilden); while Greely (Three Years of Arctic Service, Vols. I and II, 1886, *passim*, and Vol. II, pp. 360–363, summary) found them extensively distributed over Grinnell Land; yet little has been made known respecting the animals beyond some observations on their habits and localities of occurrence. In Nares' 'Narrative' (Vol. I, p. 113) is a cut, 'Head of Musk-Ox', which shows very well the narrowness of the base of the horns, but nothing apparently of the coloration. In Greely's 'Three Years of Arctic Service' (Vol. I, facing p. 104) is an engraving from a photograph of a 'Musk-Ox killed near Fort Conger', showing imperfectly the base of the horns, but no color effects; and there is a woodcut (*l. c.*, p. 363) of 'Musk-Calves at Conger, Four Months Old', from a photograph. If specimens were collected on any of these expeditions they have apparently remained undescribed.

The first intimation that either the Grinnell Land or the Greenland Musk-Oxen differed in any way from the Barren Ground stock appears to have been given by Mr. Lydekker in a recent article in 'Knowledge' (Vol. XXIII, No. 176, June, 1900, pp. 137–139), in which appears an illustration, from a photograph, of a young male captured in August, 1899, "in Clavering Island, situated off the coast of East Greenland, opposite König Wilhelm Land, in about latitude 74.5° N." In reference to this he says: "But there is one respect in which the Clavering Island calves[1] differ from the adult specimens exhibited in the British Museum, as well as from the descriptions generally given of the species. This is the presence of a large patch of white hair on the forehead, as well as of an ill-defined white streak down each side of the face, and some scattered white hairs in the middle line between the muzzle and the eyes. When this feature was first noticed, it was thought that the East Greenland Musk-Ox might prove to be a race distinct from the West Greenland and American form, in which the face is, at least in most cases, uniformly dark brown. I have, however, received from Dr. A. G. Nathorst an illustrated account in Swedish of Musk-Ox hunting in East Greenland in 1899; and the photographs in this, although they are unfortunately on a very small scale and by no means distinct, seem to show that while some of the bulls have brown faces, in others there is a considerable amount of white, yet the large frontal patch of white which forms such a conspicuous feature of the calves is, of course, obliterated by the expanded bases of the horns. Accordingly, there seem no grounds for separating the Musk-Ox of East Greenland from its representative in West Greenland and Arctic America, although the two would appear to be completely isolated" (*l. c.*, p. 138).

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[1] The calf when photographed must have been a 'yearling,' and hence not in first pelage, in which there is no indication of the future white face-spot. See *antea*, p. 72.

He appears, however, to have since changed his opinion regarding its relationship, and in a note of seven lines (Nature, *l. c.*) has proposed to call it *Ovibos moschatus wardi*. Under the title, 'A New Race of Musk-Ox,' he says: "Mr. Rowland Ward has on view at his establishment at Piccadilly a mounted adult male and female musk-ox from East Greenland, which differ from the ordinary form in having a large whitish patch on the face, as well as in certain other details of coloration. They may be made the types of a new race, under the name *Ovibos moschatus wardi*. The female was recently exhibited at the Zoölogical Society." Mr. Lydekker thus makes no reference to any difference in the shape of the basal portion of the horns in *O. wardi* as compared with those of *O. moschatus*, and we must turn to the article in 'Knowledge' (to which, however, Lydekker here makes no reference) to ascertain what are the differences in coloration, beyond the presence of a white face-patch. It seems, however, almost beyond question that Lydekker's name *wardi*, based on East Greenland specimens, is applicable to the Musk-Oxen of North Greenland, Grinnell Land, and Bache Peninsula.

We are thus indebted to Lieutenant Peary for the first indication of the peculiarities of the animal now recognized as *O. wardi*, as furnished by his half-tone reproductions of photographs of North Greenland Musk-Oxen, and also for the first specimens of this form, received, as above noted, at this Museum in November, 1899.

OCCURRENCE OF MUSK-OXEN IN ALASKA.

Richardson, in the 'Fauna Boreali-Americana' (Vol. I, 1829, p. 276), says: "From Indian information we learn that to the westward of the Rocky Mountains, which skirt the Mackenzie, there is an extensive tract of barren country, which is also inhabited by the musk-ox and reindeer. It is to the Russian traders that we must look for information on this head; . . . ." In the 'Zoölogy of the Voyage of the Herald' (Fossil Mammals, 1854, pp. 22–28), he describes various fossil remains of the Musk-Ox from the ice-cliffs of Eschscholtz Bay, and repeats, in substance (*l. c.*, p. 28), the above-quoted statement from the 'Fauna Boreali-Americana.' He also considers that the Musk-Ox skull described by Buckland (Beechey's Voyage to the Pacific, App.), found "on the beach at the bottom of the mud-cliff in Eschscholtz Bay," and "so slightly decayed that it seems to have been derived from a carcass that has long since been stranded by the waves," and not figured, "as it cannot be considered fossil," really had fallen from the cliff, and was therefore to be considered as a part of the fossil fauna of the ice-cliff (Richardson, *l. c.*, p. 22).

Mr. John Murdoch states (Rep. Exped. to Point Barrow, 1885, p. 98) that just before leaving Point Barrow, a skull of a Musk-Ox "was brought in by one of the trading parties from the eastward. . . . In the hurry and excitement of the time, we neglected to find out more accurately the locality from which it came. The party had been as far east as the Colville, and the skull may have been brought from there. The natives knew the animal well, and called it by nearly the same name as the eastern Eskimos, but none had ever seen it alive. The skull obtained appeared very old and much weathered." Apropos of this skull, Dr. F. W. True says (Nelson's Report on Nat. Hist. Coll. made in Alaska, 1887, p. 233, footnote): "This may be subfossil. The skull procured by Mr. Murdoch is very much broken and worn."

According to Mr. Witmer Stone, in his recent 'Report on the Birds and Mammals collected by the McIlhenny Expedition to Pt. Barrow, Alaska' (Proc. Acad. Nat. Sci. Philadelphia, 1900, p. 35), the McIlhenny collection made at Point Barrow contained "One weather-beaten [Musk-Ox] skull picked up on the tundra."

Mr. L. M. Turner (Contr. to the Nat. Hist. of Alaska, 1886, p. 203), referring to the Musk-Ox, says: "There is no positive evidence of the actual occurrence of this mammal within the region here included [the Yukon District and the Aleutian Islands]; but, as the northern Innuit and Indians are so well acquainted with it, there can be no doubt that it has but recently disappeared, *if scattered individuals do not yet inhabit the region northeast of the Rumianzof Mountains and near the Arctic coast.*" (Italics not in the original.)

In 1898, Mr. Frank Russell, in his 'Explorations in the Far North' (1898, pp. 235, 236), makes the following statement: "The musk-ox was formerly common between the Mackenzie and Behring Straits, as evidenced by the remains which are scattered over the tundra. The oldest natives at Point Barrow say that their fathers killed musk-ox which were then abundant. Their present distribution is from the vicinity of the Mackenzie north of Great Bear Lake to Sabine Island (74° 47′ N.) on the east coast of Greenland, and from 60° N. in the Barren Ground west of Hudson's Bay through the Northern Islands as far as man has penetrated."

The foregoing respecting the supposed existence, or recent existence, of the Musk-Ox at points near the Arctic coast of Alaska is of special interest, though mainly in the nature of hearsay evidence, in connection with the statements here following: About a year since I was informed by Mr. E. Bowsky, a fur-dresser of New York City, that he had received a fine large male Musk-Ox skin from Alaska. Although I was naturally skeptical as to the locality, I examined the specimen with great interest; it seemed, however, not to differ appreciably from the Musk-Ox of the Barren Grounds east of the Mackenzie. It was an unusually fine winter skin, with the skull. A few months later the same gentleman kindly called my attention to two other supposed Alaskan Musk-Oxen, a pair, adult male and female, and submitted correspondence showing that they were purchased and shipped at Camden Bay, Alaska, by the agents of the well-known and reliable house of Herman Liebes & Co., of San Francisco, Cal., who had also obtained, from the same point, the first specimen of this series of three. They were supposed to have been killed and prepared by the natives, who presumably obtained them a few miles inland from Camden Bay,— in other words, just where Mr. Turner believed "scattered individuals" might still exist in 1886, namely, between the Rumianzof Mountains and the Arctic coast, in northeastern Alaska.

As already said, these 'Alaskan' specimens do not appear to differ appreciably from examples of corresponding age and season from the Barren Grounds east of the Mackenzie. This is not perhaps surprising, since in comparatively recent times the species doubtless had a continuous distribution throughout the barren grounds of the Arctic coast, from Alaska eastward. Richardson, in 1854, gave its range as extending westward "to the eastward outlet of the Mackenzie," but had only vague Indian reports of its existence west of the Mackenzie.

As the remains of Musk-Oxen have been found at various points in the frozen soil of Siberia, in the ice-cliffs of Eschscholtz Bay, and, in Postpliocene times, even as far south in Europe as England and France, and in the United States as far south as Utah, Kentucky, and Mississippi, it is evident that the genus *Ovibos* is a declining type, which has reached its last stronghold in the Arctic Barren Grounds, the islands of the northeast coast of America, and a narrow coast belt in northern Greenland. Its recent history shows that it will soon be a creature of the past wherever it can be reached by man. Mr. Andrew J. Stone states (this Bulletin, Vol. XIII, 1900, p. 42): "Their range is becoming more and more contracted all the time, as roving bands of Indians from the Hudson Bay posts, on Great Slave Lake and near Great Bear Lake, make occasional raids upon them, and almost always destroy the entire herd attacked."

In Mr. Stone's notes on the Musk-Ox (*l. c.*) he stated that his inquiries among the Indians and Eskimo west of the Mackenzie River had led him to believe that this animal "has not inhabited that region for a very long period." Since the preceding part of this paper was put in type I have had opportunity again to discuss with him the question of the existence of Musk-Oxen in Alaska, and as a result he has kindly acceded to my request to put in writing a more detailed statement of his reasons for this opinion. This statement is herewith appended, since it seems to show that there is very little if any probability that the Musk-Ox still exists in any part of Arctic America west of the Anderson River. While Mr. Stone does not question that the supposed Alaska Musk-Ox skins mentioned above were shipped to San Francisco from Camden Bay, he claims, apparently with good reason, that they must have been taken far to the eastward of this point and brought to Camden Bay by whalers. His statement, dated Feb. 28, 1901, is as follows:

MY DEAR DR. ALLEN:—

In response to your inquiry in reference to the existence of the Musk-Ox (*Ovibos moschatus*) west of the Mackenzie River, or in Alaska, I will state there are none of these animals in any part of Arctic America west of the Mackenzie. Previous to my departure for the North in the spring of 1897, I had for several years carefully searched for information upon this subject, and from what I had gathered I had a faint hope of finding some of these animals in the mountains west of the Mackenzie, just south of the Arctic Coast. These mountains are known, respectively, as the Richardson, Buckland, British, Romanzof, and Franklin Mountains, but in reality they are the western extension of the main Rocky Mountain range that bends west from the Mackenzie along the Arctic Coast. On reaching the neighborhood of these mountains, however, in the winter of 1898–99, all hope of finding living specimens of Musk-Ox in them was destroyed.

The Romanzof Mountains, from which specimens of Musk-Ox are reported to have recently been brought, by way of Camden Bay, are about one hundred and seventy-five miles west of Herschel Island. The Pacific Steam Whaling Company, with offices at No. 30 California Street, San Francisco, have maintained a whaling station at Herschel Island for a number of years; there has also been established there for a number of years a Church of England Mission, under the direction of the Rev. I. O. Stringer. I visited Herschel Island in November and December, 1898, for the purpose of collecting all possible information relative to the animal life of those regions. On my way to and from Herschel Island I sledded the very base of the Davis Gilbert, Richardson, and Buckland Mountains. I stopped over night on both journeys with a lot of Eskimo, at that time hunting the Davis Gilbert Mountains and living in what is known as Oakpik (willow camp), in the extreme western part of the Mackenzie delta, very near the foot of the mountains. Specimens of *Ovis dalli* (White Sheep) and of Caribou and fur-bearing animals were plentiful in their camp, but there was no sign of Musk-Ox.

At Shingle Point, on the Arctic Coast, near the Richardson Mountains, I spent several days with a man who was trading with the Eskimo who were hunting the Richardson Mountains. There were several Eskimo in his camp at the time, and he had in his possession skins of the White Sheep, Caribou, and a variety of fur-bearing animals, but there was no sign of Musk-Ox, and I learned on careful inquiry through my interpreter that the natives seemed to know nothing of them, with the exception of one young man who had been to the eastward on one of the whaling ships. The Tooyogmioots, a tribe of Eskimo who once lived along this coast and hunted these different mountains, are now almost extinct. I found between the mouth of the Mackenzie and Herschel Island a very few individuals living in snow houses, but I did not find in or around their places of residence any sign of Musk-Ox skins, bones, or heads.

I remained at Herschel Island from Nov. 24 to Dec. 14, visiting the Rev. I. O. Stringer and Capt. Haggerty of the steam-whaler 'Mary Dehume.' Both men were able to converse readily with the Eskimo in the Eskimo tongue, and they gave me every possible assistance in making my inquiries. This whole coast far to the westward of Herschel Island is now occupied by the Noonitagmioot tribe of Eskimo. There were a large number of these people at the island, and among them were parties who hunted all the mountains of the mainland mentioned, living in the mountains a great part of the time. Many skins of Caribou, Sheep, and fur-bearing animals were seen in the possession of these people, but none of them possessed any part of the Musk-Ox, and the only members of the tribe who knew anything of the Musk-Ox were those who had been carried to the east by whaling ships. The Rev. Mr. Stringer takes great interest in the natural resources of the country and travels extensively among these people, but he had no knowledge of the existence of any Musk-Oxen west of the Mackenzie. Capt. Haggerty had wintered along this coast for a number of years, trading extensively with the natives, but he had never secured or heard of a Musk-Ox skin west of the Mackenzie.

All the whaling ships, which have wintered here for years, sometimes as many as fifteen at the same time, keep Eskimo hunters in the field continually for the purpose of securing fresh meat for the crews, sending white sailors in charge of dog sleds to visit the Eskimo camps to bring in the meat. It is not uncommon for these sleds to go one hundred and fifty to two hundred miles for meat, and all the mountains to the north and west of Herschel Island have been visited many times by these hunters and sledding parties, without obtaining any trace of Musk-Ox. Collinson, who wintered near Camden Bay in 1853–54, does not mention the Musk-Ox. The U. S. Government Survey party, which wintered on the Porcupine several years ago and visited Rampart House, a Hudson Bay trading post at the Ramparts on the Porcupine River, and who went from there with Mr. John Firth, the Hudson Bay Company's trader, north through these mountains to the Arctic Coast and returned, did not find Musk-Ox. Several white men have travelled back and forth through these mountains from Fort Yukon, on the Yukon River, to Herschel Island, for the purpose of securing sled dogs of the Eskimo on the Arctic Coast, to be used on the Yukon, without securing or learning anything of the Musk-Ox. Mr. Hodgson and Mr. Firth, both in the service of the Hudson Bay Company, have been stationed at Fort Yukon at the mouth of the Porcupine, at Rampart House on the Porcupine, and at Lapierres House on Bell River, a tributary of the Porcupine, during a period of over thirty years, trading with the Loucheaux Indians, several tribes of which hunt north of these places into the mountains mentioned, without ever obtaining any knowledge of the existence of Musk-

Ox; and the Hudson Bay Company have never secured at any of these posts any skins of the Musk-Ox.

Previous to the advent of the whalers on this coast, the coast Eskimo also traded at these Hudson Bay posts. The country between the Porcupine River and the Arctic Coast, in which district the mountains above mentioned are situated, is entirely accessible from the north or south, and every part of it has been hunted for years by the Eskimo and Indians. Barter Island, near Camden Bay, has been the rendezvous of the north coast Eskimo for years, where they meet every summer to barter and trade with each other. At one of these midsummer festivals there may be seen spotted Reindeer skins from Siberia, Walrus ivory and Walrus skins from Bering Sea, or the stone lamps from the land of the Kogmoliks (the far-away people) of the East, and it is not impossible, though hardly probable, that Musk-Ox skins might be found there.

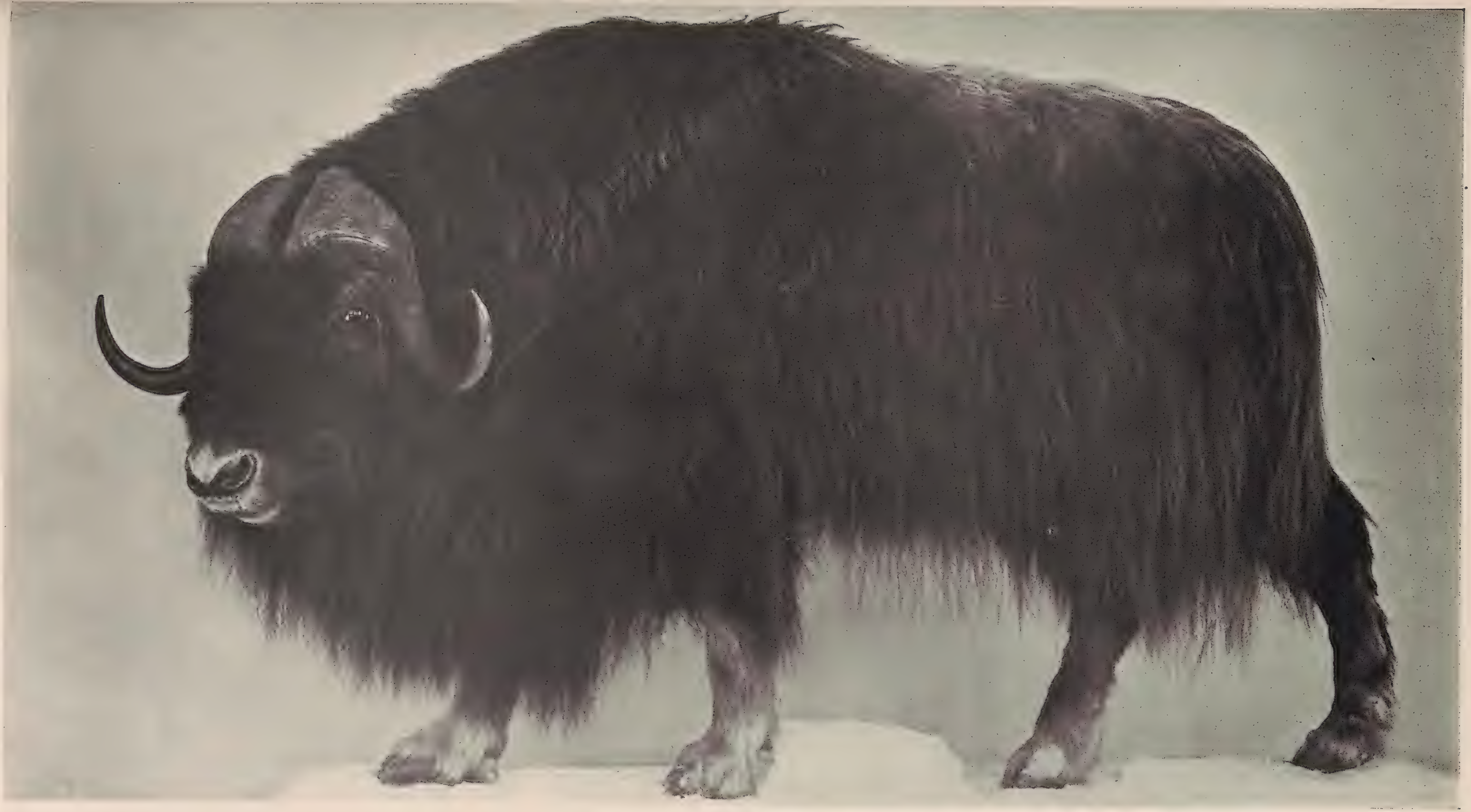
I also travelled through the country of the Kookpugmioots and Abdugmioots of the Arctic Coast, east of the Mackenzie. The first people encountered along the coast east of the Mackenzie are the Kookpugmioots — they hunt the coast country as far east as Liverpool Bay, but many of their best hunters never saw a Musk-Ox. The Abdugmioots originally hunted the Anderson River country, but now live around Liverpool Bay, and most of them have hunted Musk-Ox. The Kogmoliks, who once lived around Liverpool and Franklin Bays, but who are now practically merged with the Kookpugmioots, along the shores of Allen Channel have been Musk-Ox killers.

A good many of the Port Clarence natives, living near Bering Straits, have killed Musk-Oxen, but only around the head of Franklin Bay and on Parry Peninsula, they having been taken there by whalers. Nearly all the whaling ships pick up Port Clarence natives, on their way north and east to the whaling grounds, and keep them with them until their return, perhaps thirty months later. Some of these vessels have wintered at Cape Bathurst and in Langton Bay at the head of Franklin Bay. Four of these vessels wintered in Langton Bay in 1897–98, and during the winter their Eskimo and sailors killed about eighty head of Musk-Oxen, most of which were taken on the Parry Peninsula. When I was at Herschel Island, in the winter of 1898, I saw forty of these skins in one of the warehouses of the Pacific Steam Whaling Company. They were the property of Capt. H. H. Bodfish of the steam whaler 'Beluga.'

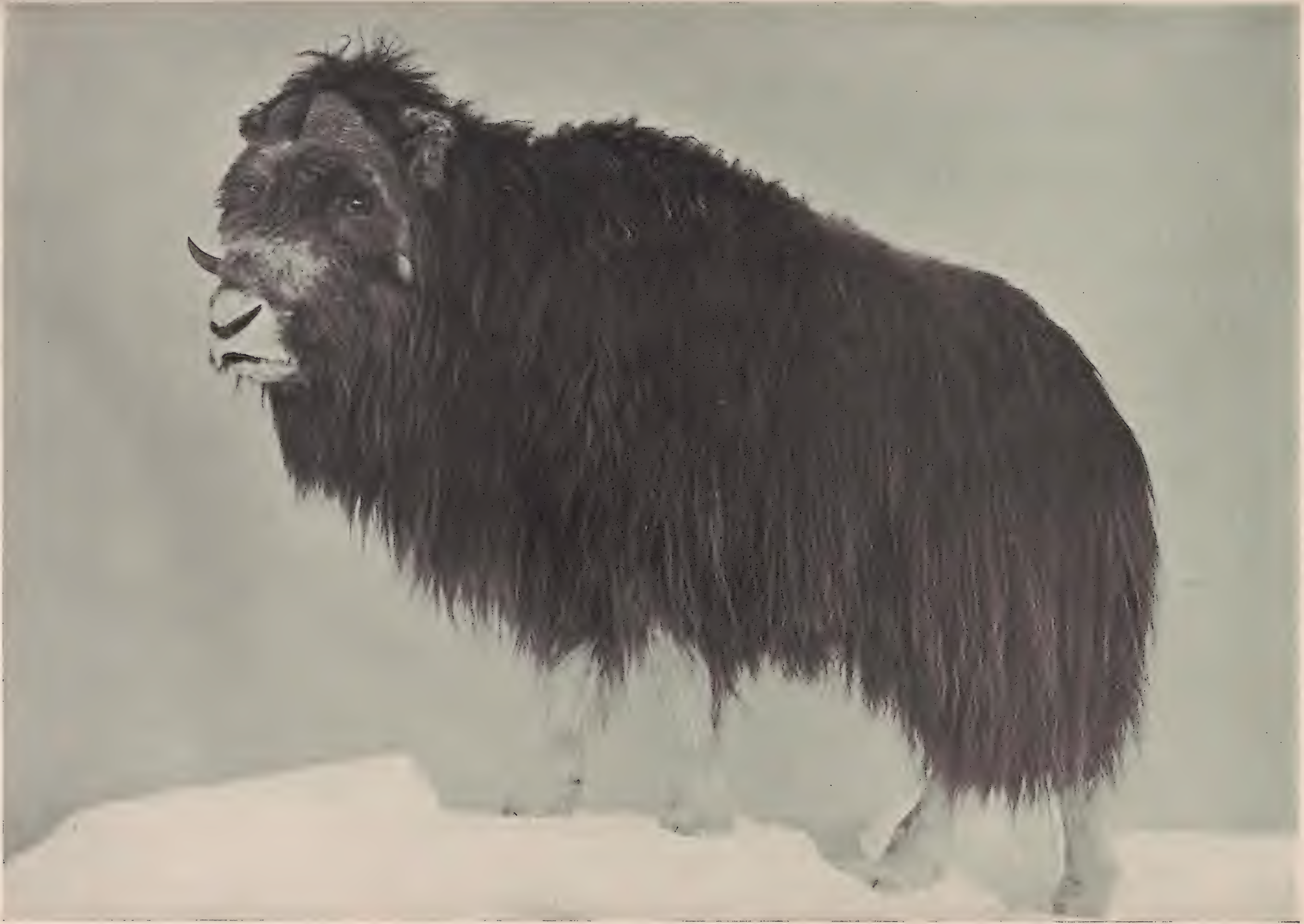
The range of the Musk-Ox at the present time does not extend westward to within three hundred miles of the Mackenzie delta. Any information concerning the Musk-Ox gathered around Point Barrow and thence south to Bering Straits and Port Clarence, has been obtained from natives who have accompanied whaling ships to the East; and all the Musk-Ox skins that find a market in San Francisco have been purchased, directly or indirectly, from the whaling ships.

Very truly yours,

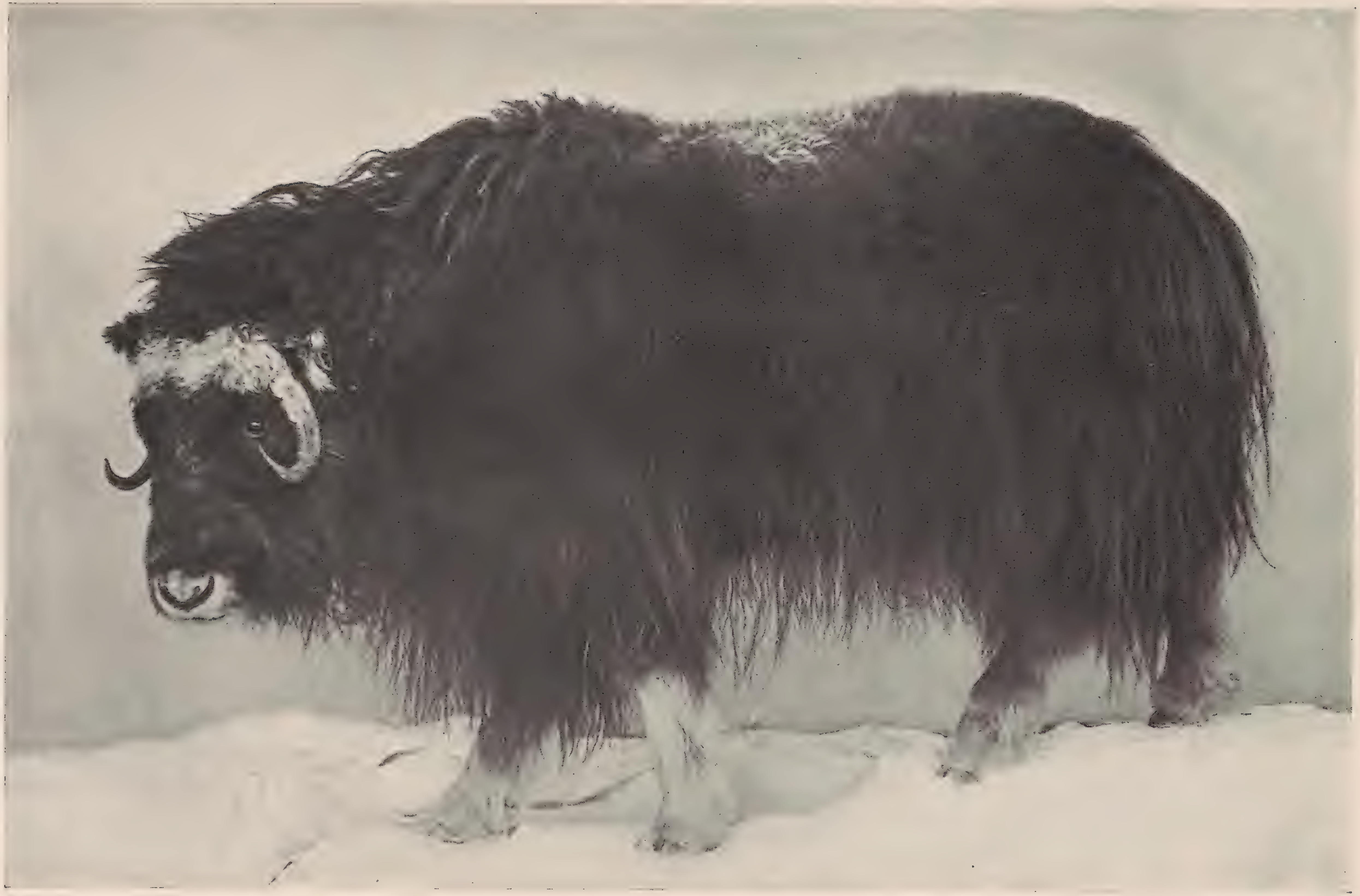
ANDREW J. STONE.



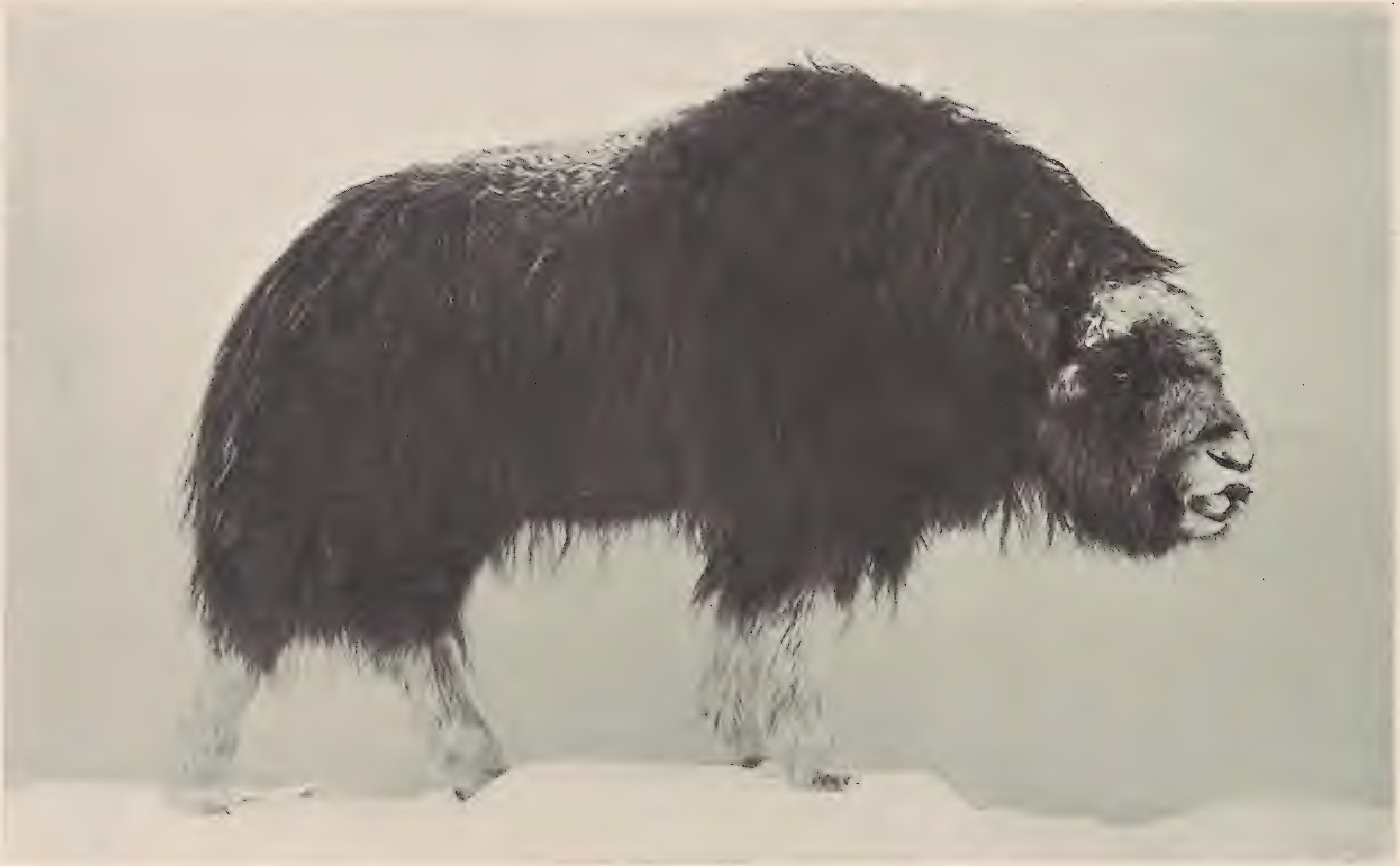
Ovibos moschatus. Adult Male.



OVIBOS WARDI. ADULT MALE.



OVIBOS WARDI. ADULT FEMALE.



OVIBOS WARDI. YEARLING MALE.

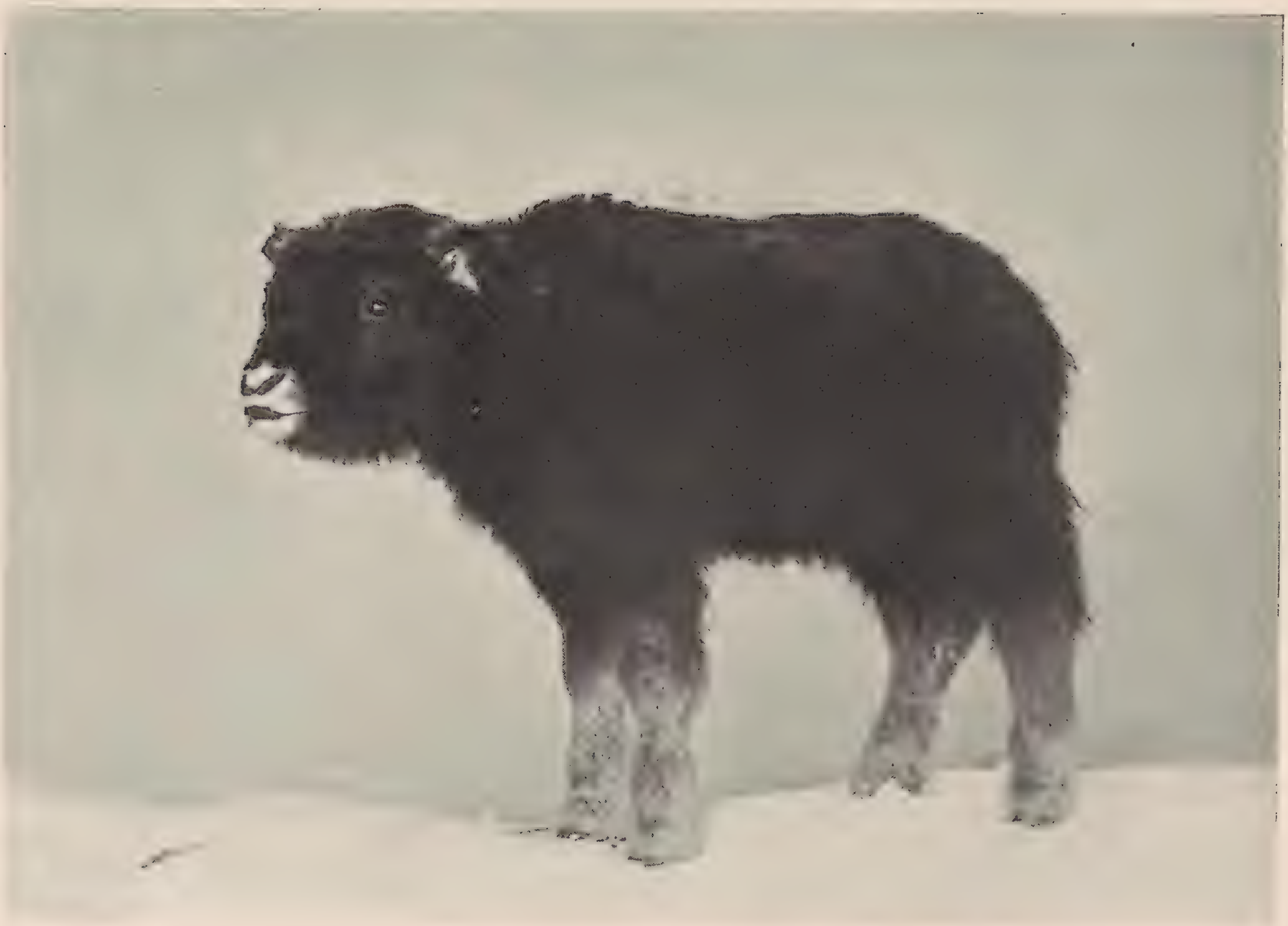


Fig. 1. *Ovibos wardi.* Calf, a few weeks old, killed at Fort Conger, May 18, 1899.

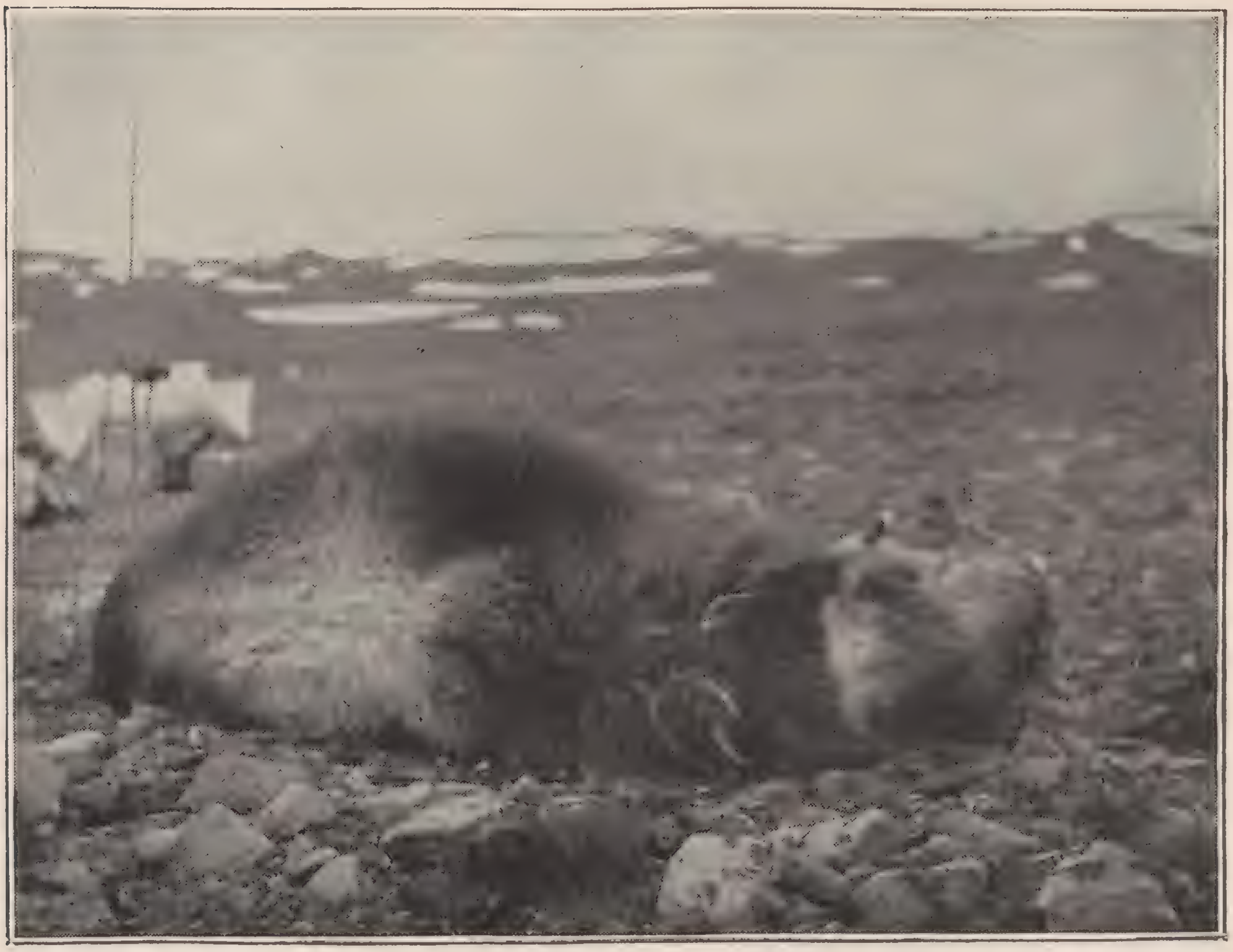


Fig. 2. *Ovibos wardi.* Killed at Independence Bay, Greenland. From Peary's 'Northward over the Great Ice,' Vol. II. p. 477.

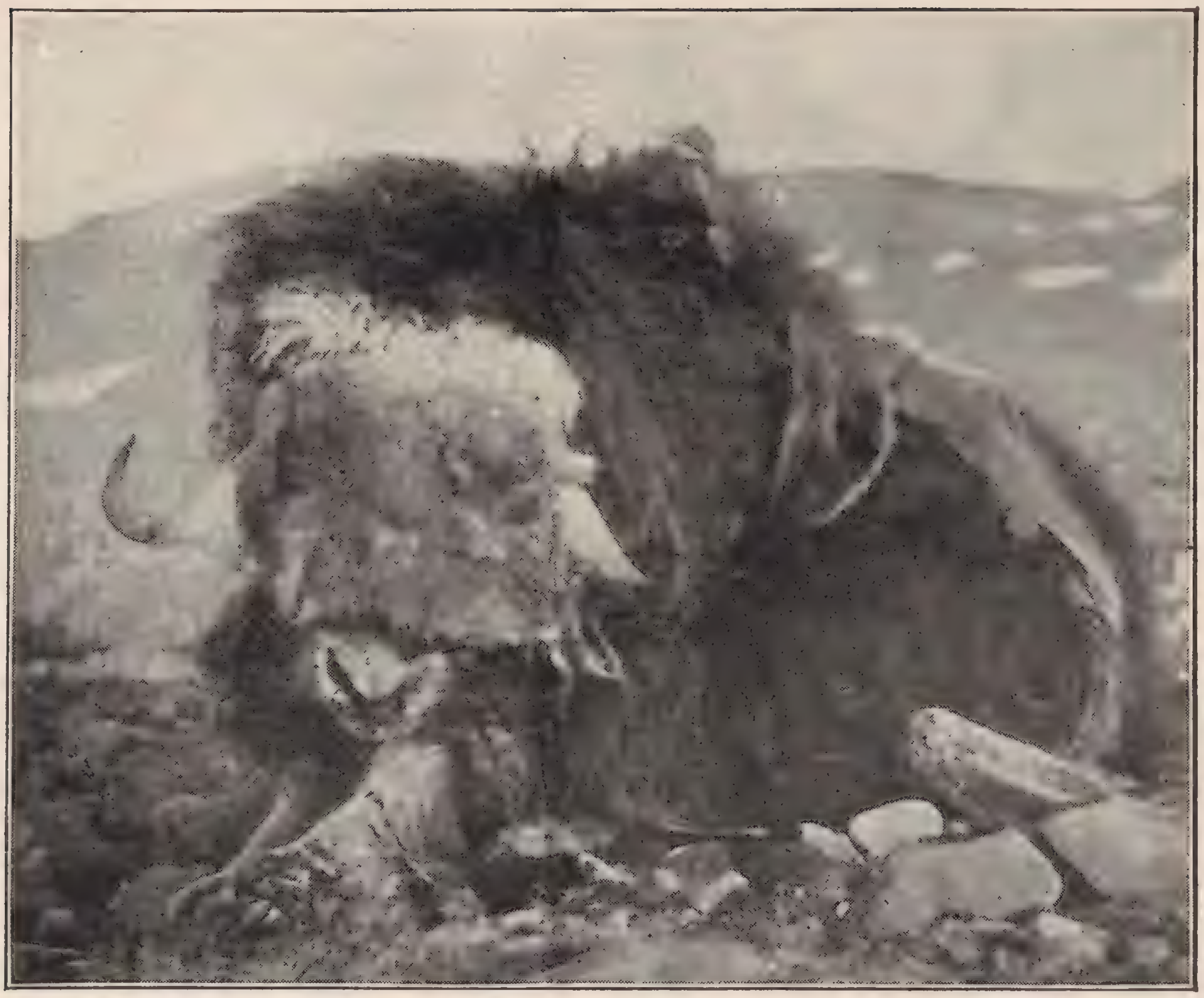


Fig. 1. *Ovibos wardi.* Old male, killed at Independence Bay, Greenland. Front view of head, showing white band behind the horns, and the very light color of the whole head. From Peary's 'Northward over the Great Ice,' Vol. II, p. 472.

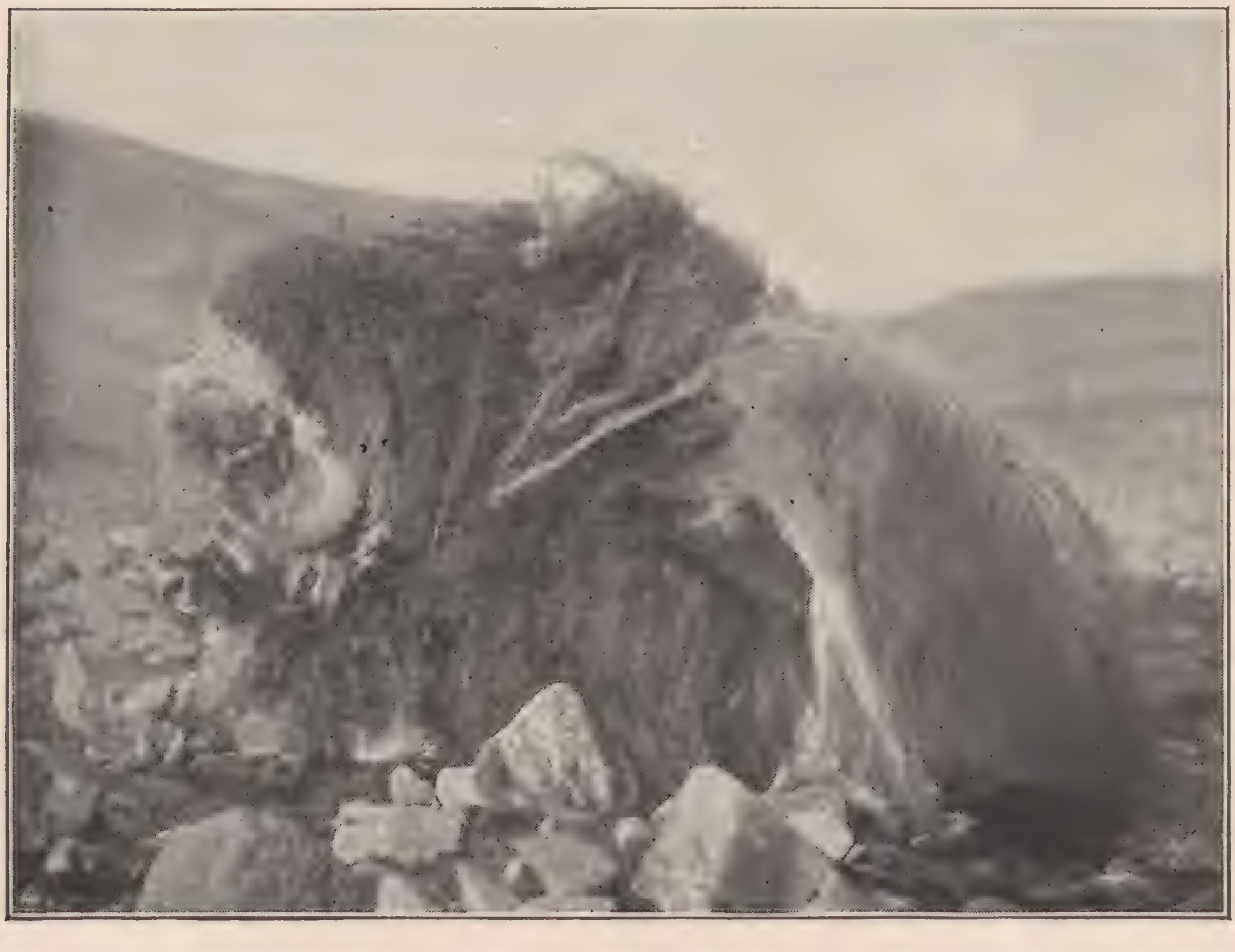


Fig. 2. *Ovibos wardi.* Old male, killed at Independence Bay, Greenland. From Peary's 'Northward over the Great Ice,' Vol. II, p. 475.

Article VIII.—A NEW RACE OF THE GREAT BLUE HERON, WITH REMARKS ON THE STATUS AND RANGE OF *ARDEA WARDI*.

By FRANK M. CHAPMAN.

An ethnological collection brought to the American Museum of Natural History from Queen Charlotte Island, B. C., by Dr. Franz Boaz, in 1888, contained the heads and necks of two Great Blue Herons so remarkable in their intensity of color as to suggest that the Great Blue Heron, like many other Northwest coast birds, had been affected in color by the humid climate of that region.

Since the date named, therefore, a complete specimen of the Great Blue Heron from the Northwest coast has been a desideratum which we have tried, until the present time, to secure in vain. In April, 1900, however, Mr. John Fannin, the well-known Curator of the Provincial Museum at Victoria, presented the Museum with an adult Great Blue Heron from Vancouver Island, but as this bird, on comparison with the Queen Charlotte Island heads and necks, evidently did not represent the extreme development of the Northwest coast form, it was deemed advisable to await the receipt of further material before attempting to characterize a new race. This material has now been received in the shape of an adult specimen collected in February, 1901, at Skidegate, Queen Charlotte Island, by John R. Swanton, of the Jesup North Pacific Expedition, whose services in this connection were enlisted through the kind coöperation of Dr. Boaz. This specimen fully confirms the suspicions aroused by the heads and necks previously mentioned, and, together with them and the Vancouver Island example, shows the Great Blue Heron of the Northwest coast region, from at least Victoria northward, to be a strikingly differentiated form, which, in recognition of Mr. John Fannin's services to the zoölogy of the region it inhabits, I propose to name

Ardea herodias fannini, subsp. nov.

NORTHWEST COAST HERON.

Chars. subsp.—Similar to *Ardea herodias* Linn., but with a shorter tarsus and with the plumage throughout much darker, the upper parts being bluish slate-black instead of bluish gray; tibiæ more feathered.

Description of Type. — Am. Mus. No. 74,294, Skidegate, Queen Charlotte Island, February, 1901, John R. Swanton.—Forehead and anterior part of the crown blackish, the feathers basally whitish gray, passing into deep black on the sides of the head and occiput, where the feathers are much lengthened; centre of the crown with elongated white feathers about half of which are laterally speckled or marked with black; a narrow dusky whitish line from the culmen to above but not, extending behind, the eye; postocular region, cheeks, chin, and throat white, passing into dark slate-gray[1] of the neck all around, except on the anterior median line, which is variegated with bright cinnamon-rufous and black; lanceolate lower neck plumes smoke-gray; back and rump bluish slate-black, the lanceolate interscapulars only slightly grayer, and therefore much darker than in *herodias;* tail somewhat grayer than the back; primaries and secondaries bluish black, tertials like the back; greater coverts slate-gray, median coverts like the back; lesser coverts much darker than the back, almost black in color; primary coverts like the primaries; border of the wing from the elbow to the wrist lightly marked with chestnut which increases in amount on the bend of the wing and extends down its outer edge to a point opposite the end of the longest primary covert; under wing-coverts similar in color to median upper coverts; jugular tufts black, each with four to six feathers medianly white; breast white, the outer half of the outer vane of the feathers black; abdomen black, many of the feathers striped laterally or medianly with white, crissum slate-gray, under tail-coverts white with blackish terminal spots and traces of rufous; sides and flanks similar to under and median wing-coverts; tibiæ feathered to within one inch of heel, outer sides similar in color to the sides but more or less washed with bright cinnamon-rufous, inner sides cinnamon-rufous; tarsi black.

Measurements.—Wing, 17.50; tarsus, 5.38; middle toe and claw, 4.10; exposed culmen, 5.90; depth of bill at angle, .76 in.

An adult male collected by Mr. John Fannin, at Sooke Lake, near Victoria, B. C., March 26, 1900, while evidently referable to the form above described, shows an approach to *herodias* in its somewhat lighter coloration and indicates the intergradation of *fannini* with *herodias* at a point further south.

REMARKS ON THE STATUS AND RANGE OF *Ardea wardi.*

The comparison of material incident to the foregoing description of *Ardea herodias fannini* gives occasion to formulate and present the opinion, long entertained, of the impropriety of according specific rank to the resident Great Blue Heron of Florida, and of the necessity of extending the range of this bird to, at least, Corpus Christi, Texas. The Florida bird, to which the name *wardi* is applied, is to be distinguished from northern specimens of *herodias* by its generally lighter colors, larger size, longer tarsus, thicker and longer bill. There is nothing in its characters to indicate specific distinctness and, indeed, they are subject to sufficient variation to make it difficult to separate some Florida specimens from those from other parts of the United States. (See in this connection, Scott, Auk, Vol. VI, 1889, p. 17.) Corpus Christi examples, for instance, in the collection of the late George B. Sennett, are practically identical with the *A. wardi* of Florida, and are so labelled by Mr. Sennett.

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[1] *Cf.*, throughout, Ridgway's 'Nomenclature of Colors.'

Nine adults collected by Dr. E. A. Mearns, at Fort Verde, exhibit an evident approach to *wardi* in their lighter color, but agree with *herodias* in size, as the appended table of measurements of adult specimens shows. In short, there seems to be no reason for believing that Ward's Heron is anything more than a southern representative of *Ardea herodias*, with which it intergrades, and that consequently it should be known as *Ardea herodias wardi* (Ridgw.). In proposing to extend the range of this form to the coast of Texas, I am well aware that specimens from further south—the coast of northern South America, for instance—have been referred to *Ardea herodias*. Nevertheless, we cannot ignore the facts in the case shown by specimens, leaving the exact status of the Great Blue Heron of the American tropics to be determined later.

MEASUREMENTS OF ADULT GREAT BLUE HERONS.

No.		Sex.	Locality.	Date.	Wing.	Tarsus.	Middle Toe and Claw.	Exposed Culmen.	Depth of Bill at Angle.
Ardea herodias	74173	—	Cape Charles, Virginia.	Jan. 1, 1901	18.25	6.75	5.00	5.50	82
" "	45753	—	Long Island, N. Y.		17.25	6.12	4.50	5.50	80
" "	69916	♂	Montauk Pt., L. I., N. Y.	Apr. 8, 1898	19.50	7.25	5.25	5.62	82
" "	11394	—	Woods, N. Y.	May 25, 1897	19.00	6.45	4.50	5.50	80
" "	11395	—	" "	" " "	18.50	6.50	4.70	5.12	80
" "	26262	♂	Knox Co., Ind.	June 11, 1877	18.00	7.50	5.00	5.77	84
" "	51033	♂	Ft. Verde, Ariz.	Sept. 13, 1885	19.75	7.12	4.75	5.75	88
" "	51035	♀	" "	Feb. 23, 1887	19.20	6.50	4.60	5.60	80
" "	51036	♀	" "	" " "	19.50	6.40	4.75	5.50	80
" "	51034	♂	" "	Dec. 26, 1885	18.00	7.00	4.90	5.40	78
" "	56534	♀	San Diego, N. Sonora.	Feb. 19, 1891	18.90	6.50	4.75	5.50	75
Ardea herodias wardi	49599	♂	La Fayette Co., Fla.	Mar. 21, 1890	20.12	8.25	5.50	6.25	92
" " "	49598	♂	" "	Mar. 21, 1890	19.25	8.00	5.30	6.00	90
" " "	36981	♀	Rutland, Fla.	Jan. 15, 1890	20.12	7.50	5.00	5.30	80
" " "	35353	♂	Tarpon Springs, Fla.	Mar. 27, 1887	20.50	8.00	5.24	6.00	90
" " "	35352	♀	" " "	" " "	20.	7.50	5.10	5.88	90
" " " G. B. S.	46	♂	Corpus Christi, Tex.	" 30, 1878	20.25	8.25	5.60	6.50	90
" " " "	47	♂	" " "	" " "	20.30	8.25	5.50	5.75	90
" " " "	5993	♂	" " "	Apr. 11, 1889	20.15	7.12	5.25	6.00	91
Ardea herodias fannini	73572	♂	Sooke Lake, B. C.	Mar. 26, 1900	19.50	5.90	4.45	5.35	80
" " "	74294	—	Skidegate, Queen Charlotte I.	Feb. —, 1901	17.50	5.38	4.10	5.90	76

Article IX.—TOOTH CHARACTERS AND REVISION OF THE NORTH AMERICAN SPECIES OF THE GENUS EQUUS.

By J. W. Gidley.

Plates XVIII–XXI and 27 Text Figures.

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Principles of Tooth Structure 43

  Tooth Characters as Altered by Age 94

  Individual Variability 101

Revision and Discussion of the Species 108

Bibliography 139

In the successive seasons of 1899 and 1900 the writer was sent by Professor Osborn to study more carefully the Paloduro (Goodnight) and Mt. Blanco beds of Texas, both of which Professor Cope had placed as typical American Pliocene. This study resulted in proving that the Paloduro beds are typical Loup-Fork or Miocene. The Blanco beds are rightly regarded as Pliocene but do not, as Cope supposed, contain any true remains of *Equus*. In the overlying true Lower Pleistocene or Sheridan Beds the writer found several skeletons which have already been described as *Equus scotti*, sp. nov. In connection with this work it appeared that the Pleistocene American Horses were greatly confused, and Professor Osborn detailed the writer to a thorough restudy and comparison of all the types, which have been carried on under his advice. The general results of this work are summarized at the close of this paper.

Fossil remains of the genus *Equus* (indigenous to North America) were reported as early as 1826 by Mitchell,[1] who referred to this genus some teeth and vertebræ found near the Neversink Hills in New Jersey, without assigning them to a species. Since that time about twenty different species have been proposed by various authors, based on material found in different localities of the United States and Mexico.

Although the remains of this genus have been found widely distributed, and very abundant in some sections, it was not until the discovery by the writer in the summer of 1899 of the excellent material upon which he founded the species *Equus scotti* that anything like a complete skull had ever been found in the United States; nor had the teeth and skeleton of a single individual ever been found certainly associated. The materials upon which the North American species were founded, and which formed the basis of the descriptions and discussions of Owen, Leidy, and Cope, were very fragmentary, for the most part consisting of disassociated teeth and bones, among which portions of maxillary bones containing several teeth were rare specimens; hence a number of the species proposed were founded on single disassociated teeth. Owing to this lack of good material and to an imperfect understanding of the characters presented in the teeth, errors have been frequent and several of the species of this genus, as they now stand, are practically indeterminate.

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[1] Catalogue of Organic Remains, New York, 1826, pp. 7 and 8.

This is the conclusion reached by the writer after a careful study of the abundant *Equus* material from the Niobrara River (collected by the American Museum expeditions of 1893 and 1897[1]), together with the skulls and associated partial skeletons from the Staked Plains of Texas, and of numerous specimens of the living species.

The object of the present paper is to present the results of this study and to attempt a revision of the species that have been proposed.

Before proceeding with the discussion, however, the writer wishes to extend his thanks to Prof. Henry F. Osborn for his valuable advice and aid in the systematic arrangement of this paper; to Mr. F. A. Lucas of the National Museum and Dr. C. R. Eastman of the Museum of Comparative Zoölogy, Cambridge, Mass., for making possible the examination of some type specimens and associated material; to Mr. Witmer Stone of the Academy of Sciences, Philadelphia, for assistance in examining the *Equus* material in the Academy that was used or identified by Dr. Joseph Leidy and Prof. E. D. Cope; and to Dr. W. D. Matthew and Dr. O. P. Hay of the American Museum, for valuable suggestions and assistance. The drawings for this paper were very carefully and accurately made by Mr. Bruce Horsfall. The photographs were taken by Mr. A. E. Anderson.

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[1] This material consists of a large number of mostly disassociated bones, teeth, jaws, and skull fragments. There are a few complete and several nearly complete molar-premolar series in the lot.

The nomenclature of the elements of the molar teeth employed in this paper is that introduced by Prof. Henry F. Osborn and is clearly indicated especially in Figs. 1 and *2a*, pp. 94, 95.

I. PRINCIPLES OF TOOTH STRUCTURE. CHARACTERS DUE TO INDIVIDUAL VARIATION AND TO AGE OR DEGREE OF WEAR DISTINGUISHED FROM TRULY SPECIFIC CHARACTERS.

The following are the chief characters used in definition by Owen, Leidy, and Cope:

Tooth Characters.

1. Degree of complexity of enamel foldings (Owen, Leidy, and Cope).
2. Degree of incurvation of superior molars (Owen, Cope).
3. Degree of curvature of superior molar-premolar series (Owen).
4. Relation of the antero-posterior and transverse diameters of the triturating surfaces of the superior molars (Owen, Cope).
5. Ratio of antero-posterior diameter of protocone to antero-posterior diameter of whole triturating surface (Cope).
6. Comparative size (considered unimportant unless difference was considerable) (Owen, Leidy, Cope).
7. Presence or absence of cup in external lower incisor (Cope).
8. Relative size of third superior molar (Owen, Cope).
9. Crimpled or ptychoid enamel of fossette (Cope).
10. Character of the separation of the lobes of the metaconid-metastylid columns (Cope).

Skull Characters Relative to the Teeth.

11. The position, in relation to the teeth, (a) of the anterior extension of the maxillary ridge, (b) of the anterior extension of the palatal notch, (c) of the post-palatal foramina; also (d) the amount of the posterior projection of the maxillary beyond m^3 (Cope).

More importance has been attached to most of these characters, apparently, than their merits warrant; evidently, therefore, the only way of forming an estimate of their true value is to find out, in a large series of specimens, in what way and how much these characters may be affected in the individual and in different individuals of the same species.

The conditions which affect the tooth character of the Horse may be classed under two heads: (A) *Age* and (B) *Individual Variability.*[1]

A.—Tooth Characters as Altered by Age or Degree of Wear.

(I). *Effect of Wear on Complexity of Enamel Folding.*

When a molar or premolar tooth first comes into use, the face, as well as the sides of the crown, is completely covered with enamel (Fig. 2, *A*), which folds in and out, and (though somewhat hidden by cement) presents the same general appearance as that seen in the much more primitive forms, *Anchitherium* and *Mesohippus.* Soon the enamel on the tips of the cones and along the ectoloph wears through, and small patches and ridges of dentine completely surrounded by a border of enamel are exposed. (Fig. 2, *B.*) As the tooth is further worn away, these patches and irregular ridges broaden and rapidly lengthen until when about one-half to three-quarters of an inch of the crown

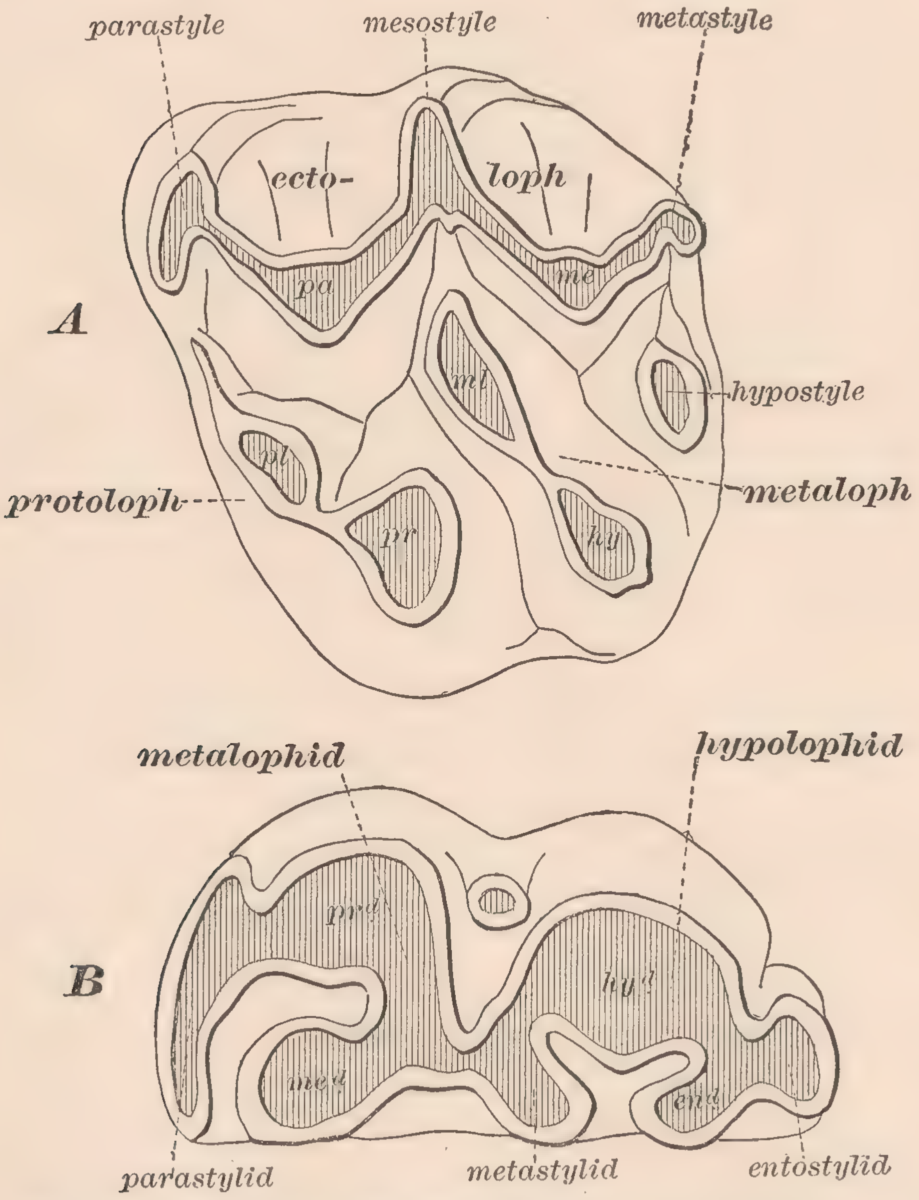

Fig. 1. Molars of Horses showing terminology. *A*, Upper molar, *Anchitherium*. *B*, Lower molar, *Merychippus*. (After Osborn.)

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[1] Sex seems to affect the tooth characters only in the canines, which are always prominent in the adult males, but absent or at best vestigial in the females; hence this factor is left out of the discussion.

has been worn away they have all become united by narrow isthmuses, and the fundamental tooth pattern of the horse is presented. (Fig. 2, *C*, *D*.) The five prominent points or cusps on the triturating surface of a newly erupted molar or premolar tooth are the paracone, metacone, protocone, protoconule, and a cusp apparently formed by the union of a ridge thrown out from the hypostyle meeting the metaloph at about its middle point. (Fig. 2, *A*.) The cusps forming the ectoloph are very early united, as is also the protocone with the protoconule. The next points of union are usually at the anterior and posterior walls of the tooth, where the protoloph unites with the parastyle, and where the hypostyle unites with the metastyle ; usually then the antecrochet and crochet unite, and finally the metaloph extending across from the metaconule unites with the ectoloph directly opposite the mesostyle ; this is because the metaloph is usually much depressed opposite

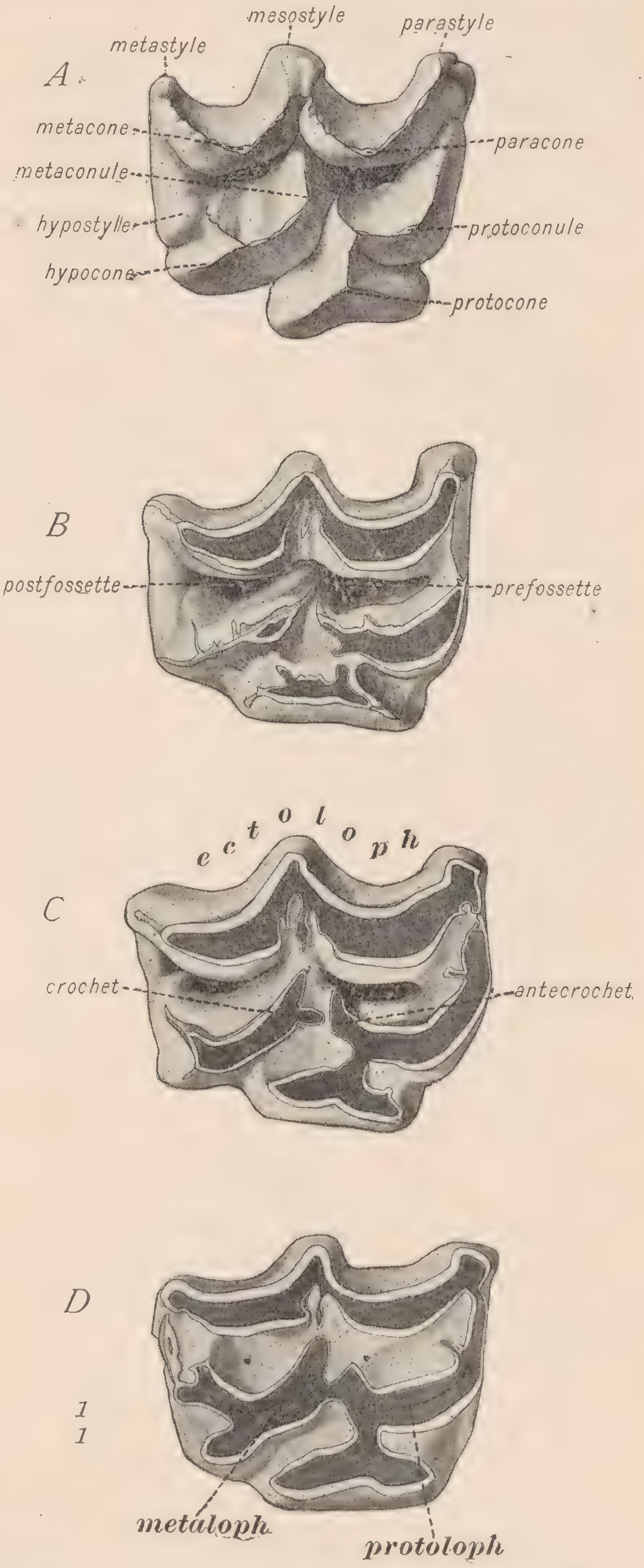

Fig. 2. Cusps, Crests, Styles, Crochets, and Fossettes in the molar teeth of the Horse (*E. complicatus*). *A*, unworn crown. *B–D*, successive stages of wear.

the mesostyle, leaving the pre- and post-fossettes continuous after all other connections have been formed. Thus a continuous irregular wall of dentine is formed entirely around the tooth leaving a deep valley or inlet on the internal face of the crown and two large fossettes or lakes separated by the narrow transverse wall of the metaloph. The outside wall of dentine is bounded externally by a thin sheet of enamel, as are also the isolated fossettes. Just below the point where all these ridges and cusps are well united, appear the most elaborate enamel foldings, of the fossette borders, that are to be seen at any stage of wear.

From this point, which is usually about one-half to three-quarters of an inch below the face of the unworn crown, the triturating surface presents a gradually less complex pattern of enamel folding as the tooth crown is worn away, until in the very much worn tooth the simplest pattern of enamel folding is presented. Thus it may happen that a tooth will present the most elaborately complex enamel foldings when it is little worn, and become most simple in this respect when in old age the crown is worn very short, exhibiting all the intermediate stages in the course of wear. This principle is demonstrated in Fig. 3. *A* represents the little worn crown (No. 2726, Nebraska Coll.) of a fossil tooth of moderately complicated pattern. A^1, A^2, and A^3 are three sections of the same tooth, and A^4 indicates where each of these sections was cut. Note the difference in general of the fossettes and also the changes in the character of the outside enamel foldings.

(II). *Effects of Wear on the Proportions of the Teeth.*

1. The Teeth Taken Individually.

Unlike the degree of complexity of the enamel foldings, the corresponding diameters are affected differently by wear in different teeth of the molar-premolar series. The same general rule for the change in ratio of the antero-posterior to transverse diameter may be applied to the intermediate teeth $p\underline{3}$ to $m\underline{2}$ inclusive, but the most anterior and posterior teeth ($p\underline{2}$ and $m\underline{3}$) are affected differently, in this respect, from the intermediate teeth of the series and from each other as well.

a. Laws Governing the Changes of Diameters of the Tooth Crowns.

There seems to be no exception to the following laws for the changes of diameters of the tooth crowns as they are worn away by use.

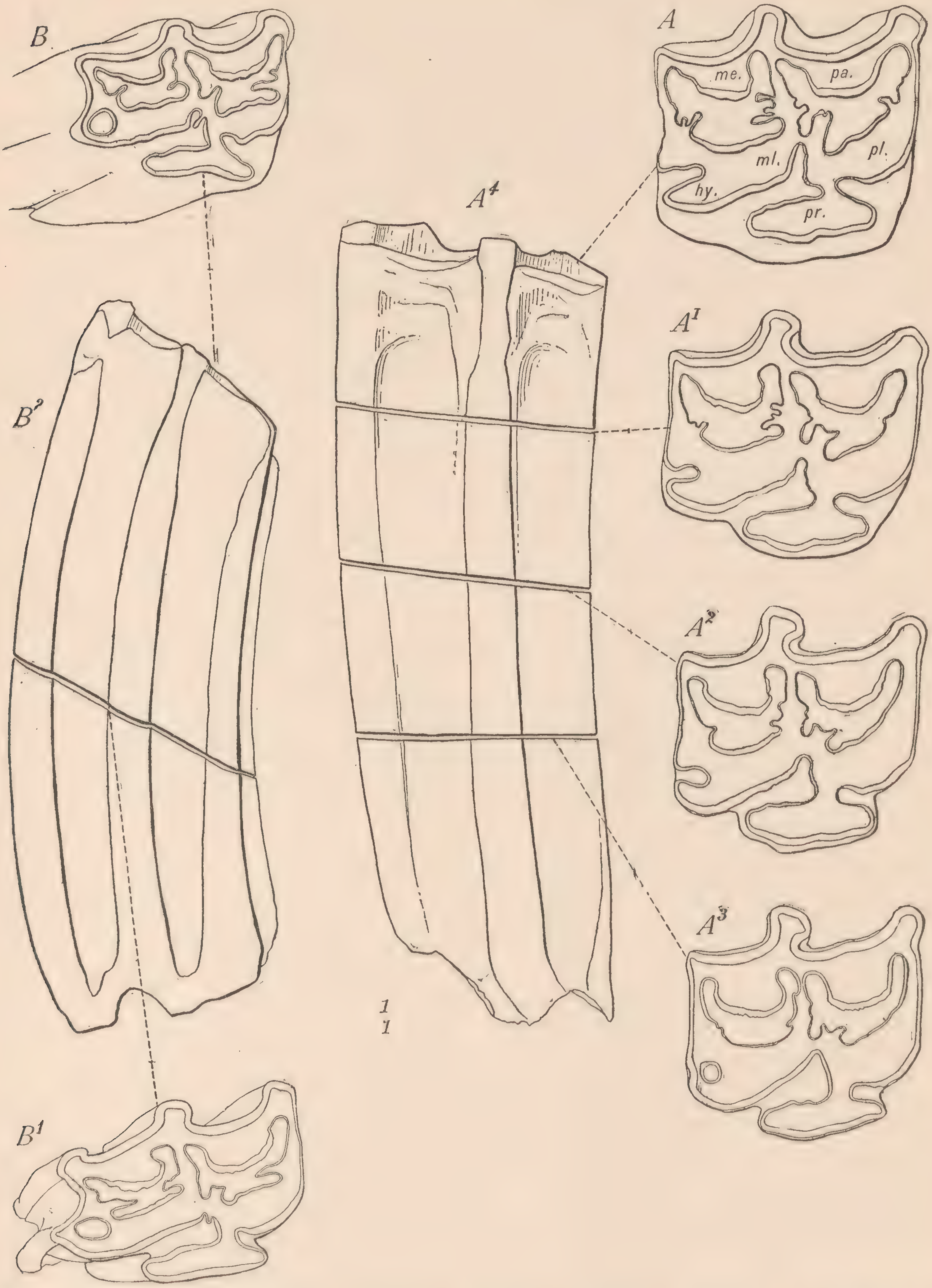

Fig. 3. Superior molars of *Equus complicatus*, sectioned to illustrate changes in dimensions and pattern at different stages of wear. *A*, triturating surface of $m^{\underline{1}}$. A^1, A^2, and A^3, sections cut parallel to triturating surface. A^4 shows where sections were cut; *B*, triturating surface of $m^{\underline{2}}$; B^1, section; B^2 shows where section was taken.

TABLE I. MEASUREMENTS ON THE TRITURATING SURFACES OF THE UPPER TEETH OF EQUUS CABALLUS AND EQUUS ASINUS.

	Description.		Approximate age.	Catalogue Number.	Diameters in mm.[1]						
						p^2	p^3	p^4	m^1	m^2	m^3
Series 1.	*Large draught Horse*	♀	5 years	16274	Antero-posterior	40	32	30	30	30	29
					Transverse	27	28.5	27.5	27	26.5	21.5
					Antero-posterior, Protocone	11	14.5	15	13.5	15.5	16
	" " "	♂	8 "	14131	Antero-post	36.5	29	28	25.5	25.5	29.5
					Transverse	25.5	28	27	26.5	26	22
					Antero-post., Protocone	10	13.5	14	13	15	16
	" " "	♂	15 + "	289	Antero-post	38.5	29.5	28.5	24	25	30
					Transv	23	27.5	28	26	25.7	22.5
					Antero-post., Protocone	9.3	13	13	11.5	12.5	12.8
	" " "	♂	12 + "	No number	Antero-post	40	30.5	30	27	27	29
					Transv	28	30	28.5	28	26.5	23
					Antero-post., Protocone	10	14	14	13	13.5	13
Series 2.		♀	20 ± years	16277	Antero-post	36	26	25	21.5	21.5	30
					Transv	24	26.5	27	25	25	22.5
					Antero-post., Protocone	9	10	11	10	12.5	14.5
		♂	20 ± "	16275	Antero-post	33.5	25.5	25.5	22.5	23.5	26.5
					Transv	23	26.3	26	25	25	23
					Antero-post., Protocone	10	12	13.5	13.5	15	14
	Thoroughbred	♀	6 "	Loaned by C. R. Knight	Antero-post	33.5	27.5	28	25	25.5	27.5
					Transv	25	26.5	26.5	25.5	25	21.5
					Antero-post., Protocone	8.5	13	13.5	13.5	13.5	15
	Texas Pony	♂	7 "	No number	Antero-post	35	28	26	24	24.5	28.5
					Transv	23	25.5	25	25	24	21.5
					Antero-post., Protocone	8	10.5	10.7	10.5	10.5	11
Series 3.	*Domestic Ass*	♀	5 years	15675	Antero-post	33	26	25	22	23	23
					Transv	24.7	25	24	22.5	22.5	18.5
					Antero-post. Protocone	6.5	9.5	10.5	8.5	9.5	10.5
	Mexican Burro	♂	6 "	No number	Antero-post	31	24.5	23.5	21.5	21.5	22
					Transv	23	24.3	24	23.3	21.5	18
					Antero-post., Protocone	6.5	8.5	9	9	9	10.5

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[1] In every case the transverse diameters were measured across from the exterior ridge of the mesostyle to the exterior wall of the posterior lobe of the protocone, exclusive of cement.

[Total length of three of the above skulls are as follows: No. 16274, 604 mm.; No. 14131, 573 mm.; Texas Pony, 515 mm.]

(1) The *antero-posterior* diameters of the grinding surfaces of all the intermediate teeth are greatest at the stage when the tooth has just fully come into use, that is, when about one-half of an inch, or less, of the crown has been worn away; from this point the antero-posterior diameter diminishes very rapidly for a short distance and then continues to diminish more gradually to the roots of the tooth.

(2) The antero-posterior diameter of the first premolar ($p^{\underline{2}}$) remains about the same for the whole length of the crown, except that sometimes it narrows slightly near the roots.

(3) The antero-posterior diameter of the last molar ($m^{\underline{3}}$), however, is relatively small at first, and increases continually as the tooth is worn away.

(4) When the teeth first come into use the *transverse diameters* of all the teeth of the series are quite narrow, owing principally to the rapid incurving of the ectoloph; this diameter increases very rapidly for about one-half to three-fourths of an inch, but from this point to the roots of the teeth the transverse diameters of $p^{\underline{3}}$ to $m^{\underline{2}}$ inclusive remain about the same, diminishing slightly near the roots; $p^{\underline{2}}$ gradually diminishes while $m^{\underline{3}}$ increases in transverse diameter as the crown wears away.

(5) The antero-posterior diameter of the protocone in all the teeth of the series remains the same for the whole length of the crown.

(6) The antero-posterior or long diameter of the incisors diminishes with age while the transverse diameter increases.

b. Effect of Wear on the Relative Measurements of Tooth Crowns.

(1.) *Ratio of the antero-posterior to the transverse diameter.*

It will be seen from the foregoing that owing to the very slight variation of the transverse diameters of the crowns of $p^{\underline{3}}$ to $m^{\underline{2}}$ inclusive, for almost their entire length, and to the great shortening of their antero-posterior diameters, the ratio of these diameters in these teeth is very different in old and in young individuals of the same species. Thus in the little worn condition of these teeth in a young horse, especially before the teeth have worn to that stage where the transverse diameter is greatest, the antero-posterior diameter is always greater than the transverse. As the crown wears away, the antero-posterior diameter diminishes and a stage is reached where the two diameters are about equal, then, as the antero-posterior becomes still more shortened, the transverse exceeds it. In every series this variation in ratio seems always to be most advanced in $m^{\underline{1}}$ and $m^{\underline{2}}$. This is evidently due not only to the order in which the teeth of the horse come into use, whereby the first to appear would at a given stage be most worn, but also, as is shown by an examination of Table I (p. 98), because the range of reduction of the antero-posterior diameters is greater in the molar than in the premolar teeth. $M^{\underline{1}}$ is always the most advanced, as it comes into use before any of the others of the permanent set.[1]

(2.) *Ratio of antero-posterior diameter of the protocone to the antero-posterior diameter of the crown.*

The antero-posterior diameter of the protocone, being, like the transverse diameter of the crown, practically unchanged through wear, also holds to the ever-changing antero-posterior diameter of the crown in the old and much worn tooth a very different relation from what it did when the tooth first came into use. Thus, it may happen that in a little worn tooth the antero-posterior diameter of the protocone is *much less than half* that of the entire crown, but may become *greater than half* this diameter when the tooth has become much worn in consequence of this shortening of the antero-posterior diameter of the crown.

2. On the molar-premolar series as a whole.

The shortening of the antero-posterior diameters of all the other teeth in the series, except $p^{\underline{2}}$, is not nearly compensated by the lengthening of this diameter in $m^{\underline{3}}$, hence it results that the series, as a whole, becomes much shortened and the teeth from behind crowd forward toward $p^{\underline{2}}$ which retains the same relative position in the skull, so that $m^{\underline{3}}$ shows the greatest displacement and the discrepancy in length is all taken from the posterior end of the series. The gap which would otherwise be left in the maxillary bone behind $m^{\underline{3}}$ becomes gradually filled in with a new growth of bone, as the teeth shift forward, leaving a flattened ridge which is continuous with the rugose prominence or ridge which marks the posterior extension of the maxillary bone beyond $m^{\underline{3}}$; hence the length of this posterior extension of the maxillary depends principally upon the age of the horse. In passing from the young to the old stage, there is also a marked change in the relative position, with respect to the molar teeth, of the anterior projection of the maxillary ridge, the post-palatal foramina, and the anterior projection of the post-palatal notch,—all appearing relatively more posterior in the old individual.

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[1] The order of appearance or eruption of the permanent teeth of the large species from Texas (*E. scotti*) is the same as Owen has given for *E. caballus*, and is: first, m^1, second, m^2, third, p^2, fourth, p^3, fifth, p^4, sixth, m^3. This is probably the order in all other fossil species of this genus.

B.—INDIVIDUAL VARIABILITY.

a. *Degree of complexity of the enamel foldings of the teeth.*—The examination of a large number of specimens of *E. caballus*, many of them of about the same age, shows a great variability in this character aside from that caused by wear; this indicates that individual variability also has a very wide range, and no two specimens can be found, even of the same age and species, in which the enamel foldings of the corresponding teeth are exactly alike, and even corresponding teeth of the opposite sides of the same skull often show slight differences in the number and style of the minor enamel folds. Fig. 4 (*A* and *B*) represents the corresponding teeth ($m^{\underline{2}}$) of two very large draught horses of the same variety, with apparently only about a year's difference in age, the one represented by *A* being the younger. These teeth show considerable difference in the degree of complexity of the enamel folding, which may be due in part to their difference in age, but specimens can be found in individuals of the same age in which the difference is just as great. The corresponding tooth of the Texas pony (Pl. XIX, Fig. *D*) is much simpler than either of the above, yet the degree of wear of the teeth shows that this tooth was apparently intermediate in age between those of *A* and *B*, Fig. 4.

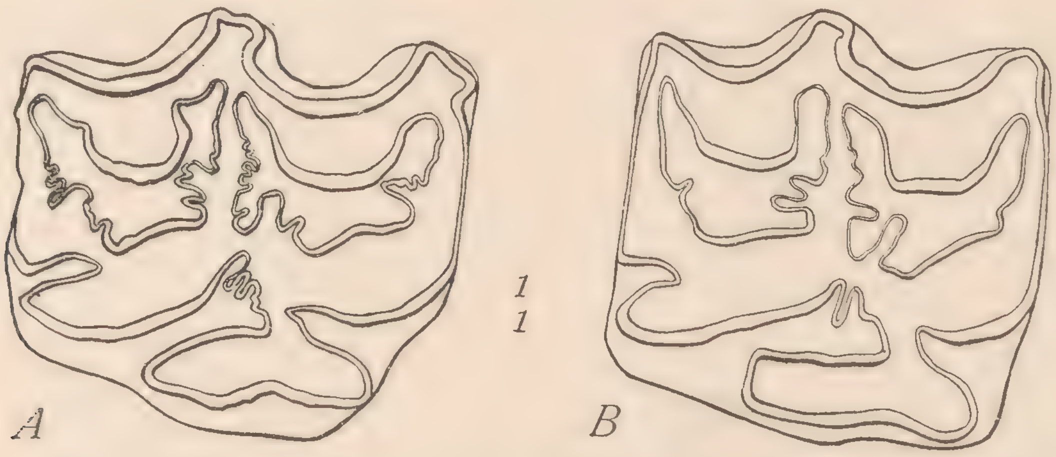

Fig. 4. Superior molars m^2, *E. caballus*. *A* and *B* of different individuals of about the same age, showing variation in plication.

Although domestication may have made the range of individual variability greater in *E. caballus*, yet a careful examination of a large number of fossil teeth indicates that in the extinct species as well the range for this character was great.

b. *Effect of individual variability on dimensions of the teeth.*—It has been shown under the topic of age variations that the transverse diameters of all the superior molars and premolars, except $p^{\underline{2}}$ and $m^{\underline{3}}$, the antero-posterior diameters of the protocones of all the teeth and the antero-posterior diameter of $p^{\underline{3}}$ are measurements which change but slightly for much the greater length of the crown; hence, unless specimens of the same age are taken for comparison, it is in these measurements that one should look for evidences of individual variability. Careful measurements of the teeth of more than ten specimens of *E. caballus* have led to the following conclusions: (1) The transverse diameters of the corresponding teeth for $p^{\underline{3}}$ to $m^{\underline{2}}$ inclusive are remarkably constant, especially in skulls of nearly the same size; the greatest difference in a certain series of four skulls of large draught horses examined not exceeding 2.5 mm., and in another series of three skulls belonging to animals about the size of carriage horses being less than 1 mm. (See table of measurements, p. 98.)

The transverse diameters of $m^{\underline{2}}$ of the large series vary only .8 mm., while in the small series all the transverse measurements for this tooth are the same. The greatest difference in the transverse diameter of $m^{\underline{2}}$, including both series of skulls, is only 1.5 mm., and adding a skull of the Texas pony to the list the extreme difference between the transverse diameter of $m^{\underline{2}}$ of this whole lot of skulls, ranging in size from the large draught horse to the small Texas pony, is only 2.5 mm. It will be seen by reference to the table of measurements (p. 98) that the average variation of the corresponding transverse diameter for all these teeth is very small considering the great difference in size of the animals represented.

It seems reasonable that much greater variations of the comparatively constant characters of the teeth would be found in *E. caballus* than in the extinct species, since in this species domestication and breeding have caused such a very wide range in size and proportions of the individuals; hence, when, in two lots of fossil horse teeth, the difference between the transverse diameters of corresponding teeth is on the average greater than that between the large and small varieties of *E. caballus*, it would seem that the teeth of the two lots could scarcely belong to the same species, and although the character of size, alone, could hardly be considered sufficient ground for establishing a species, yet where this difference exists, it seems reasonable to expect that when skulls which represent such two lots of teeth are known, other differences will be found which will clearly mark them as distinct species.

It has been shown that the antero-posterior diameter of the protocone is very little affected by wear; Table I (p. 98), makes it clear, however, that the range of individual variability of this diameter is very great, and cannot be depended upon as a distinguishing character even in corresponding teeth of individuals of the same size.

The Lower Teeth.

The characters of the lower teeth are, in general, affected in the same way as the upper, and seem to be of even less value in determining the species. A detailed discussion of the lower teeth will therefore be omitted, except in regard to a character given by Cope, that of the presence or absence of a cup in the external incisors. An examination of the large amount of material at

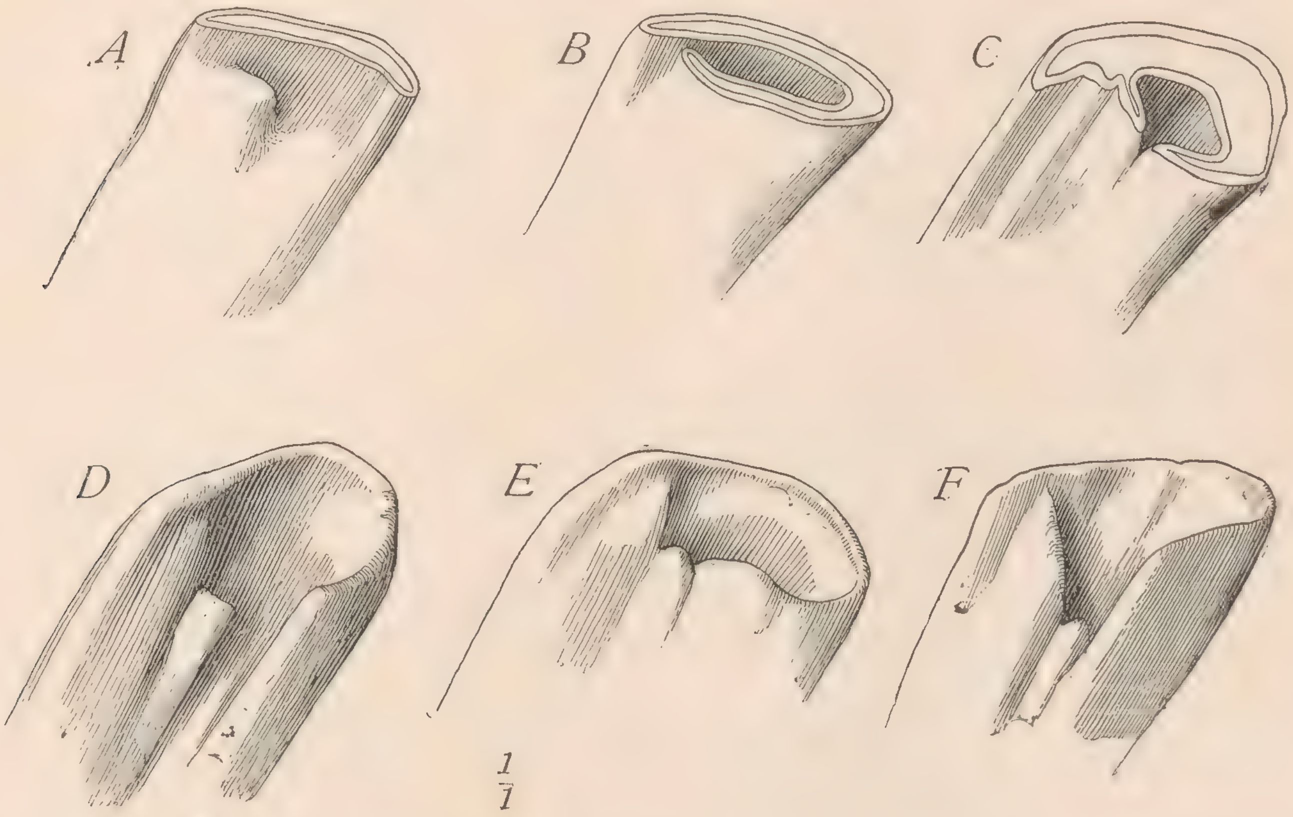

Fig. 5. External lower incisors showing development of cups. *A*, *B*, *C*, *E. caballus*; *D*, *E*, *F*, *E. scotti*.

hand shows: (1) that the fully developed cup is usually present in *E. caballus*, though not always, the writer having examined three specimens in which it is entirely wanting (Fig. 6, *C*); (2) in the two jaws of *E. asinus* in the Museum collection there is no indication of even a tendency toward cupping of the external incisors; and (3) the fossil species of *Equus* in which this character can be made out

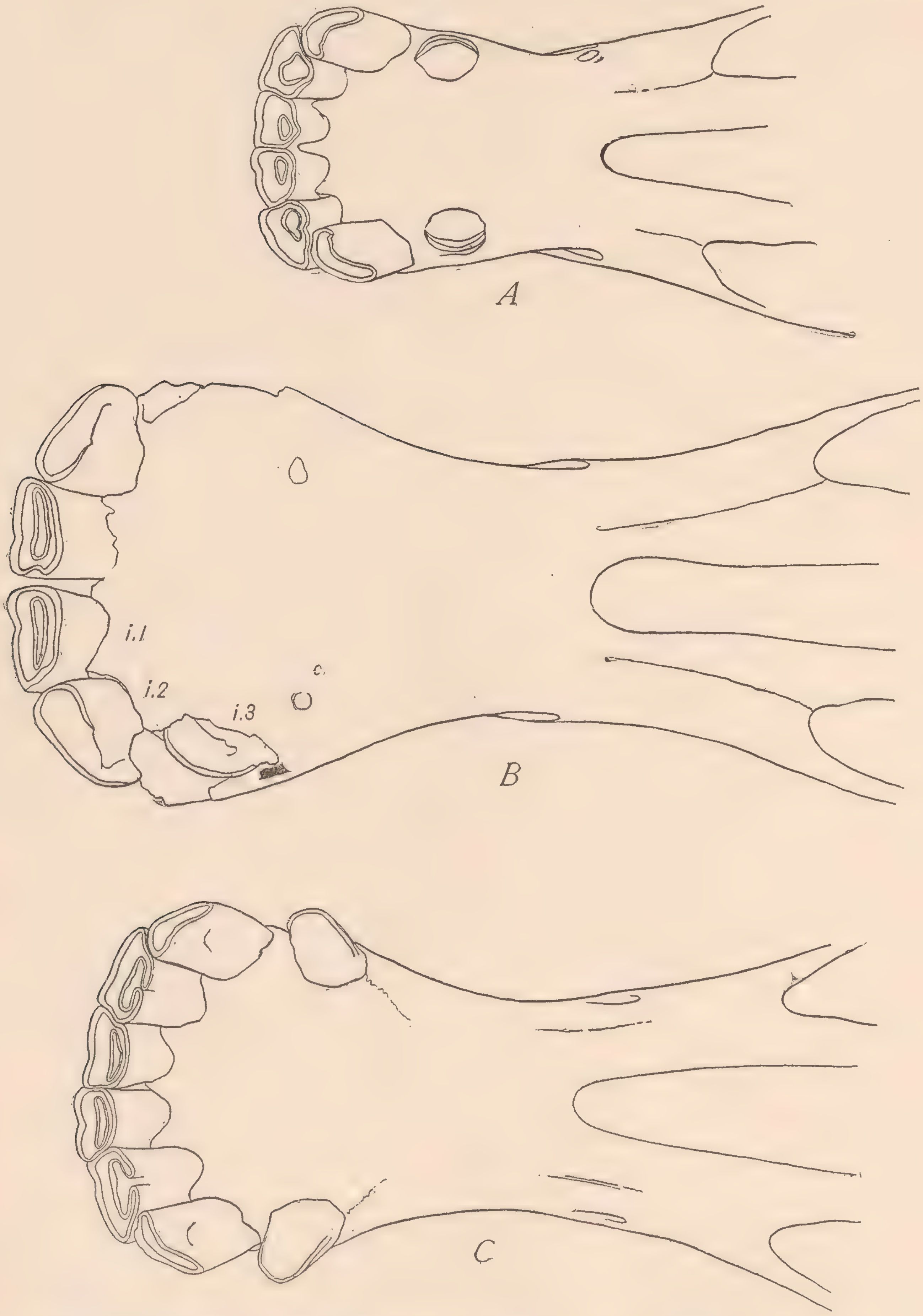

Fig. 6. Mandibular symphyses. *A*, *E. asinus*; *B*, *E. scotti*; *C*, *E. caballus*.

show all the intermediate stages as well as both extremes of this character. A fact worthy of mention here is that in the American Museum material, the absence of a cup, or a very much interrupted inner wall, of the external incisor, is the rule in the species with a short muzzle, while in *Equus scotti*, which is a long-nosed type, the entire absence of a cup is much less frequent. Figure 5 shows a series of lower external incisors (*A*, *B*, *C*,) of *E. caballus* and another (*D*, *E*, *F*) of *E. scotti*, illustrating the variability of this character. The only other character of the lower teeth which Cope[1] seemed to consider important is the form of the groove or channel separating the two lobes of the metaconid-metastylid column, which he designates as (1) a "sharp entrantangular groove," (2) an "open gutter," (3) a "flat channel." An examination of a large number of lower teeth of *Equus* and of the Loup Fork genera of horses soon convinced the writer of the great variability and extreme unreliability of this character in specific determination. In the Loup Fork genera it seems to be the rule that when the separation of the lobes of the metaconid-metastylid column is well marked, the bottom of the groove is nearly always sharp, but when not well marked then the groove may be said to be a flat channel. It seems to be only a matter of individual variation as to which character is presented. In all the species of the genus *Equus* this separation is usually an open gutter.

SUMMARY.

An application of the foregoing principles of the variability of tooth characters to the specific definitions used by Owen, Leidy, and Cope shows the unreliability of most of the characters they have employed. Thus the degree of complexity of the enamel folding is seen to be greatly affected by both age and individual variability — a fact which must be correctly understood before this character can be of even subordinate value as a specific determinant; the other characters given by these authors have been shown to be so affected by either age or individual variability, or both, that no dependence whatever can be placed on any of them; and it has been also shown that size, especially the transverse diameter of the molars and premolars, although least account has been taken of it, is more constant in a species than any other tooth character hitherto used.

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[1] Report Geol. Surv. Tex., 1893, p. 66.

If the foregoing interpretation of the tooth characters of the genus *Equus* is correct, it seems evident that the synopses for a determination of the species given by Cope have very little value, and no dependence can be placed on them. For convenience of reference one of these synoptic tables is given below.[1]

"I. Long diameter of anterior internal lobe of sup. molars not greater than one-third the long diameter of the crown.

" Borders of lakes crenate; internal anterior lobe notched on the inner side so as to be bilobate; crowns a little curved; large.......... *E. crenidens.*

"II. Long diameter of anterior internal lobe more than one-third and not more than one-half the antero-posterior diameter of the crown.

α Crowns more or less curved.

" Crowns wider than, or as wide as, long; enamel edges little folded. *E. curvidens.*

$\alpha\,\alpha$ Crowns straight or nearly so.

β Diastemata longer.

" Crowns nearly square, enamel not very complex; no facial fossa; maxillary bone produced much beyond $m\underline{3}$ .... *E. caballus.*

$\beta\,\beta$ Diastemata shorter.

γ No facial fossa.

" Crowns nearly square; enamel not very complex; maxillary bone little produced behind last molar; smaller.

E. hemionus; E. burchelli; E. quagga; E. zebra; and *E. asinus.*

" Crowns longer than wide on face; enamel little complicated; face and maxillary unknown; large................................ *E. occidentalis.*

" Crowns square; enamel more folded than in other species; face and maxillary unknown; large..................................... *E. major.*

γ A facial fossa.

" Crowns nearly square; enamel less complex; maxillary short posteriorly; smaller... *E. andium.*

"III. Long diameter of anterior inner lobe more than half that of crown of molar teeth.

" Crowns square; enamel little complex (in Mexican specimens); diastemata and maxillary behind shorter; no facial fossa; large....... *E. excelsus.*

" Crowns square; enamel little complex; smallest species...... *E. barcenæi.*"

The synopsis written by Cope and published in the Journal of the Acad. Nat. Sci., Phila., 1899, Vol. XI, part ii, p. 255, seems likewise to have no standing.

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[1] Proc. Am. Phil. Soc., Vol. XXII, 1884, p. 10.

CHRONOLOGICAL TABLE OF PROPOSED SPECIES REPORTED FROM THE UNITED STATES.

No.	NAME.	DATE AND PUBLICATION.	COLLECTION CLAIMING TYPE.	TYPE FIRST FIGURED.
1	*Equus* sp. Mitchel	Append. N. Y. div. Cuvier's Theo. Earth, 1826	Not known.	Not figured.
2	" *curvidens* Owen	Odontography, 1842, p. 575	Mus. Royal College Surgeons	Voyage H.M.S. Beagle, 1840, Pl. 32, fig. 13.
3	" *major* De Kay	Nat. Hist. N. Y., Zöol., I, 1842, p. 184	Not known.	Not figured.
4	" *americanus* Leidy.	Proc. Acad. Nat. Sci., Phila., 1847, p. 265	Cabinet Acad. Nat. Sci., Phila	Proc. Acad. Nat. Sci., 1847, Pl. 2, fig. 1.
5	" *fraternus* "	" " " " " 1858, p. 11	Am. Mus. Nat. Hist., Holmes Coll., No. 9200	Holmes's Post-Plio. S. C., 1860, Pl. 15, fig. 8.
6	" *complicatus* "	" " " " " 1858, p. 11	Same as *E. americanus*	Same as *E. americanus*.
7	" *excelsus* "	" " " " " 1858, p. 26	National Museum, Washington	Extinct Mam. Faun. D. & Neb., 1869, Pl. 21, fig. 31.
(8)	" (cf. *Protohippus*) *perditus* Leidy	" " " " " 1858, p. 26	(?) National Museum, Washington	Extinct Mam. Faun. D. & Neb., 1869, Pl. 17, fig. 1.
9	*Equus occidentalis* Leidy.	" " " " " 1865, p. 94	Mus. Comp. Zoöl., Cambridge, Mass.	Fossil Vertebrates, 1873, Pl. 33, fig. 2.
10	" *pacificus* "	" " " " " 1868, p. 195	Not known.	Not figured.
(11)	" (cf. *Protohippus*) *parvulus* Marsh	Am. Jour. Sci., Vol. XLVI, 1868, p. 374	(?) Yale University	Not figured.
12	*Equus conversidens* Owen	Phil. Trans., London, 1869, pp. 563–564	Museum Nacional, Mexico	Phil. Trans., 1869, Pl. 61, fig. 1.
13	" *tau* "	" " " 1869, p. 565	" " "	" " " Pl. 61, fig. 4.
14	" *crenidens* Cope	Proc. Am. Phil. Soc., Vol. XXII, 1884, p. 12	" " "	Not figured.
15	" *barcenæi* "	" " " " " " 1884, p. 15	" " "	" "
16	" *simplicidens* "	" " " " Vol.———., 1892, p. 124	Texas Geol. Surv., Austin, Texas	Proc. Am. Phil. Soc. 1892, fig. 1, p. 124.
17	" *eurystylus* "	Report. Geol. Surv., Texas, 1893, pp. 43–45	Texas Geol. Surv., Austin, Texas	Geol. Surv. Tex., 1893, Pl. 20, fig. 6.
18	" *cumminsii* "	" " " " 1893, p. 67	Texas Geol. Surv., Austin, Texas	" " " 1893, Pl. 20, fig. 7.
19	" *minutus* "	" " " " 1893, pp. 67–68	Texas Geol. Surv., Austin, Texas	" " " 1893, Pl. 20. fig. 8.
20	" *semiplicatus* "	" " " " 1893, p. 80	Texas Geol. Surv., Austin, Texas	" " " 1893, Pl. 23, fig. 2.
21	" *intermedius* "	Proc. Am. Phil. Soc., 1895, pp. 463–464	(?) Tulane University, New Orleans	Proc. Am. Phil. Soc. 1895, Pl. 9, fig. 8.
22	" *fraternus pectinatus* Cope	Journal Acad. Nat. Sci., Phil., 1899, pp. 252–259.	Acad. Nat. Sci., Philadelphia	Not figured.
23	*Equus-phlegon* Hay	Am. Geologist, Vol. XXIV, 1899, p. 345	Same as *E. minutus*	Same as *E. minutus*.
24	" *eous* "	Science, Vol. IX, 1899, p. 593	Same as *E. intermedius*	Same as *E. intermedius*.
25	" *scotti* Gidley	Bull. Am. Mus. Nat. Hist., Vol. XIII, 1900, pp. 111–116	Am. Mu. Nat. Hist., No. 10606	Am. Bull. 1900, fig. 2, p. 113, fig. 3, p. 114.
26	" *giganteus* Gidley	Bull. A. M. N. H., Vol. XIV, 1901, pp. 137, 138.	" " " " No. 8616	" " 1901, fig. 27.

II.—REVISION AND DISCUSSION OF SPECIES.[1]

(2) *Equus curvidens* Owen.

Type Locality.—Punta Alta in Bahia Blanca, Argentina, S. A.

Horizon.—Found together with remains of *Megatherium*, *Megalonyx*, etc.

Type.—Superior $m\underline{2}$; little worn.

Author's description.—"A greater relative antero-posterior diameter than in the recent horse, but especially is it distinguished by the greater degree of incurvation of the upper molars."

Measurements.

$m\underline{2}$	Antero-posterior diameter	27 mm.
	Transverse "	24 "

This species must remain rather indeterminate until better material reveals its true distinguishing characters. Although Leidy at one time referred to it some *Equus* teeth found in the United States and, so far as defined above, some of the teeth in the American Museum collection might be placed in this species, the probability is that *E. curvidens* differs from any of the North American species, owing to its wide geographical separation from them.

(3) *Equus major* De Kay.

Type Localities.—Neversink Hills, N. J.; north bank of Susquehanna, near Georgetown, D. C.; North Carolina.

Types.—Indeterminate, cited by author as follows: "Some teeth and vertebræ belonging to the genus *Equus*."

Author's description.—"They [the teeth and vertebræ] resemble those of the common domestic horse; but from their size, apparently belong to a larger animal."

E. major is practically a *nomen nudum*, as no figures or measurements were ever given and it seems impossible now to locate the original specimens.

(4) *Equus americanus* Leidy.

Leidy first applied this term to three superior molar teeth (Fig. 7) from Natchez until he ascertained that it was preoccupied by Gervais for a South American type; he then substituted the term *E. complicatus*.

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[1] For dates, location of types, etc., see Chronological Table, p. 107. The names of valid species are in heavy-faced type.

(6) **Equus complicatus** (*Leidy*).

E. americanus Leidy (non Gervais).

Type Locality.—Near Natchez, Mississippi.

Horizon.—Tenaceous blue clay underlying a diluvial deposit.

Type.—A second superior molar of the left side. *Cotypes*: Two third superior molars of the right side.

Author's description. — "The enamel folds are one-fourth thicker than in the recent horse and the isolated enamel folds of the superior molars are much more plicated, resembling in this respect the *Equus plicidens*, Owen."

Measurements.

m^2 {
Antero-posterior diameter = 1.2 of an inch = 30 mm.
Transverse diameter = 1.1 of an inch = 27 mm.

When Leidy first described this species he gave it the name *E. americanus*, but, as explained above (4), he later substituted the name *E. complicatus.*[1] This name was employed by Leidy for some time,[2] but in his great Memoir of 1869 (Leidy, 1869, p. 264) he made *E. complicatus* a synonym of *E. major*, apparently without any justifiable reason, stating only that he suspected these two species to be the same. Thus, although *E. major* was employed continuously by Leidy and by Cope until 1899,[3] the name really has no standing and *E. complicatus* should be retained.

The species *E. complicatus* itself is imperfectly characterized except

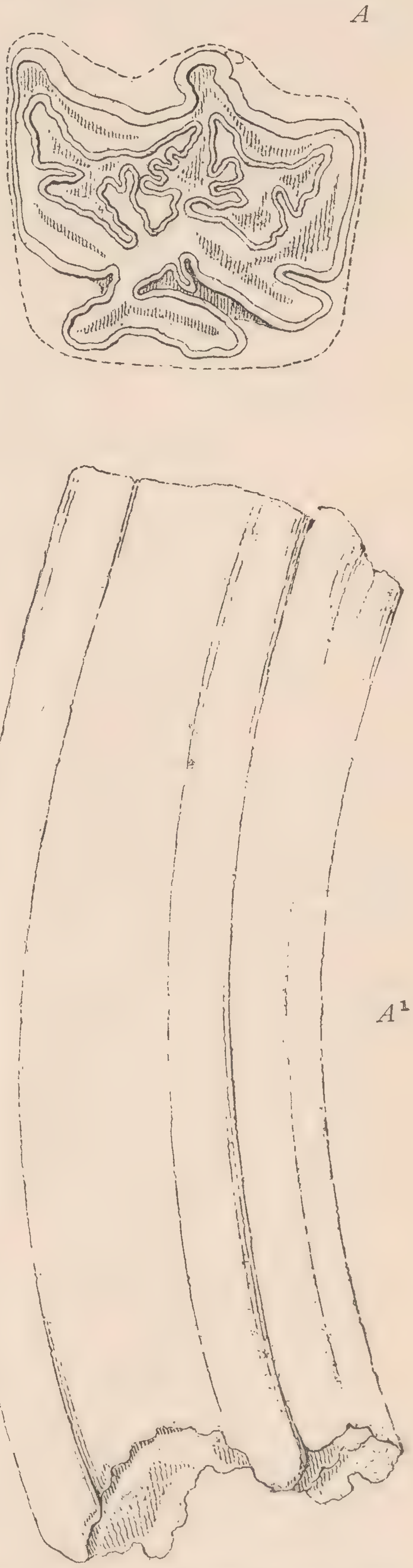

Fig. 7. Type of *Equus complicatus*. *A*, triturating surface; *A*^{1}, side view of crown. (After Leidy.)

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[1] Proc. Acad. Nat. Sci. Phila., 1858, p. 11.

[2] Holmes's Post-Pleiocene of So. Carolina, 1860.

[3] On p. 259 of the Port Kennedy Cave Memoir (Cope, 99), Cope remarked that having looked nto De Kay's account he finds no definite application of the term, *E. major*, can be made.

in point of size, and although many teeth from different localities have been referred to it, there is no assurance as to their reference.

Among the teeth subsequently referred by Leidy to *E. complicatus* were those on which Cope founded his species (21) *E. intermedius* (= *E. eous*, Hay) found at Petite Anse, La., not over 100 miles distant from the type locality of *E. complicatus;* they belonged to an old individual, and the differences are principally age characters; Leidy was probably correct therefore in his previous reference of these types to *E. complicatus.*

(5) **Equus fraternus** LEIDY.

Type Locality.—Near Charleston, S. C.
Horizon.—Phosphate Beds.
Type.—Superior $\underline{p^2}$.

Author's description.—As has been pointed out by Cope,[1] when Leidy first named this species he gave no description by which it could be distinguished, simply stating that "its remains are undistinguishable from the corresponding parts of the recent horse, and are the representative of the *E. primigenius* of Europe, and may be distinguished by the name of *E. fraternus.*" He afterward figured and described a number of teeth from near Charleston, S. C.,[2] referring some of them to this species and others to *E. complicatus.* From the teeth of this collection designated by Leidy as *E. fraternus*, Cope selected a tooth (No. 6, Pl. xv, H. P. S.) as the type of *E. fraternus.* Quoting from the publication referred to, he says: "The superior molar which is first described is figured on Pl. xv, Fig. 6, of that work (Holmes's Post-Pleiocene Fossils of S. C.). Unfortunately the protocone of that tooth is largely broken off, but enough remains to show that it had the very small antero-posterior diameter characteristic of the Floridian teeth, and in other respects it agrees with them, except that it is larger than usual. . . . I therefore regard it as the type of the species as described by Leidy." As there are apparently two species represented by the figures designated by Leidy as *E. fraternus* it is important that the right tooth be selected as the type of this species; it is evident that Cope made a mistake in this selection, for the tooth to which he referred was not described at all by Leidy but simply mentioned and that not until after the teeth represented by figures 19–22, Pl. xvi, and figure 8, Pl. xv, had been described. The teeth represented by figures 19–22, Pl. xvi, are a composite lot of undistinguishable lower teeth regarded by Leidy as belonging to *E. complicatus* and *E. fraternus.* Since he mentioned figures 19 and 21 as exhibiting "a greater degree of plication in the enamel than is usual in any of the lower molars of the horse, whether recent or extinct," he evidently regarded these two teeth as belonging to *E. complicatus* and probably regarded the other two as belonging to *E. fraternus.* But as there seems to be really nothing in the teeth themselves by which they can be separated or distinguished, the choice of the type of *E. fraternus* seems necessarily to fall on the next described tooth which is represented by figure 8, Pl. xv, and described on page 102 of the above work.

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[1] Proc. Am. Phil. Soc., Vol. XXXIV, 1895, p. 467.
[2] Holmes's Post-Pleiocene of S. C., 1860, pp. 100 to 105, Pl. xv and xvi.

This tooth, taken by the writer as the type of *E. fraternus* (see Figure 8, *A*, No. 9200, Coll. Am. Museum Nat. Hist.), seems to represent in general the teeth to which Leidy intended to apply this name, and seems to represent also this species, as understood by Cope, more nearly than the tooth selected by him as the type. Cope evidently was led to error in the description of his selection of the type by the poor representation of this tooth as originally figured by Leidy, for Figure 8, *B*, a careful drawing taken from the tooth itself, shows that the protocone has not the "characteristically small antero-posterior diameter" which he attributed to the Florida specimens, but is rather large. As there seems to be nothing then to separate this tooth from *E. complicatus*, it should properly be referred to that species.

E. fraternus (thus clearly separated from the type used for it by Cope and based upon the first characteristic specimen mentioned by Leidy) then represents a rather small species of horse about intermediate in size between *E. complicatus* and *E. tau* as described and figured by Owen, with the enamel foldings inclined to be quite complicated in pattern, as is indicated by two other teeth, in the American Museum collection, probably belonging to this species (Nos. 9217 and 9203, Coll. Am. Museum, represented by figure 8, *C* and *D*). The side views of the crowns show that they

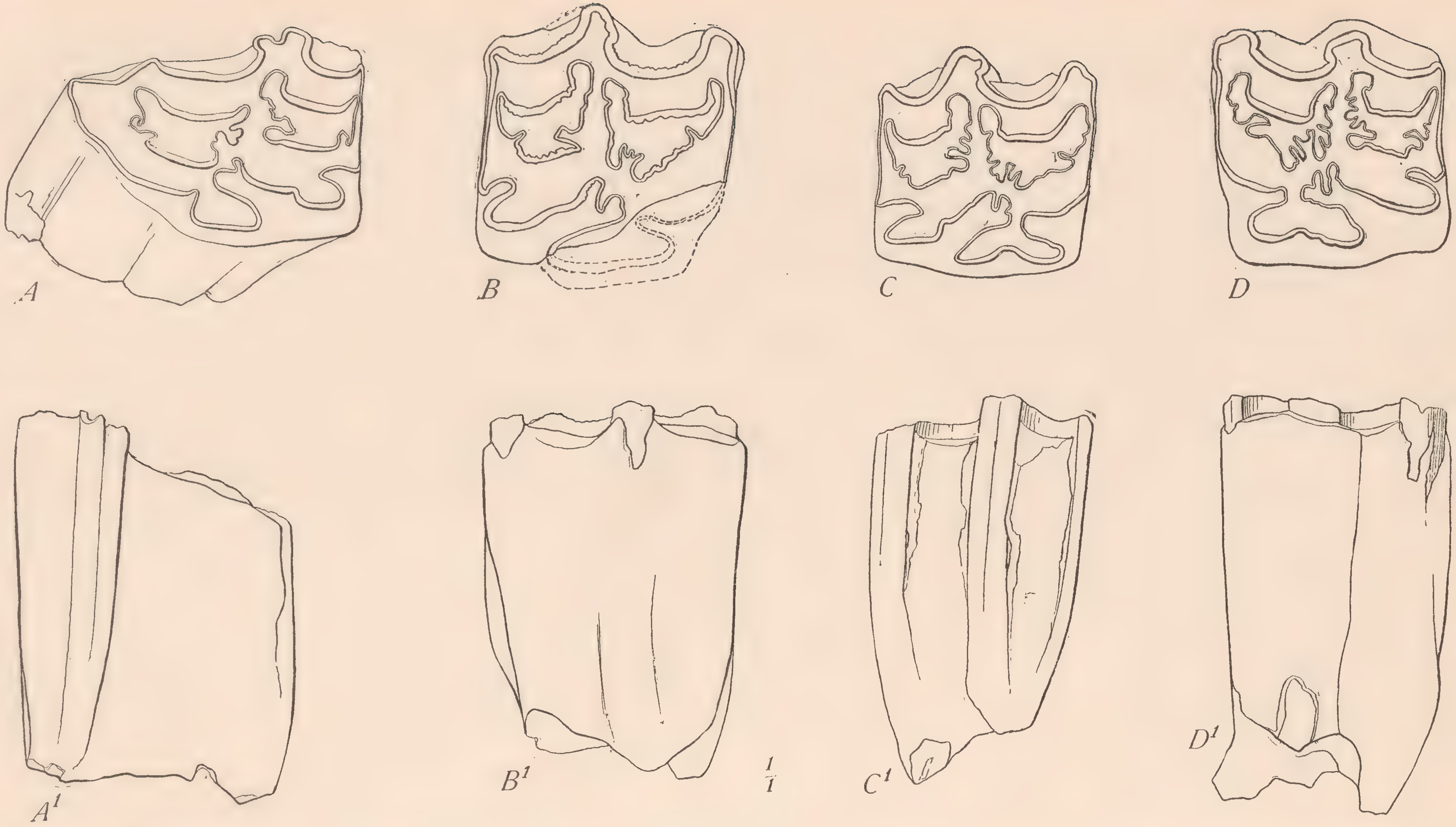


Fig. 8. Superior molars of *E. fraternus* and *E. complicatus*. *A*, crown view; *A*^{1}, external view of p$^{\underline{2}}$, *E. fraternus*, type. (No. 9200, Coll. A. M. N. H.)
B, crown view; *B*^{1}, external view of m$^{\underline{1}}$, *E. complicatus* ("type" Cope, *E. fraternus* Leidy, No. 9202, Coll. A. M. N. H.).
C, crown view; *C*^{1}, external view m$^{\underline{1}}$, *E. fraternus*. (No. 9217, Coll. A. M. N. H.), Florida.
D, crown view; *D*^{1}, external view of p$^{\underline{3}}$, *E. fraternus* (No. 9203, Coll. A. M. N. H.), Charleston, S. C.

are well worn and hence near the stage when the simplest form of tooth pattern would be presented.

Measurements of type tooth.

$\mathrm{p}^{\underline{2}}$	Antero-posterior diameter	32 mm.
	Transverse "	23 "

Measurements of Nos. 9203 and 9217.

$\mathrm{p}^{\underline{3}}$ (So. Carolina)	Antero-posterior diameter	25 mm.
	Transverse "	24 "
$\mathrm{m}^{\underline{1}}$ (Florida)	Antero-posterior "	23.5 "
	Transverse "	24.5 "

(7) *Equus excelsus* Leidy.

Type Locality.—Pawnee Loup Branch of the Platte River, Neb.

Type.—A fragment of the right side of an upper jaw, containing $\mathrm{p}^{\underline{4}}$ – $\mathrm{m}^{\underline{3}}$ inclusive.

Author's description. — "About the size of the largest variety of recent horse. . . . The teeth do not differ in constitution from those of the recent horse; and none of them present a greater degree of complication of the enamel folds on their triturating surface."

Leidy gave no further identification of this species in his original description, but in his publication, 'The Extinct Mammalia of Dakota and Nebraska,' 1869, p. 266, he gave as an additional character, "the absence of the little infolding of the enamel at the bottom of the deep valley between the median and posterior columns of the upper molar teeth"; and he figured the type specimen on Pl. xxi, fig. 31, of that work.

Measurements of Teeth.

$\mathrm{p}^{\underline{4}}$	Antero-posterior diameter	28.5 mm.
	Transverse "	28.5 "
$\mathrm{m}^{\underline{1}}$	Antero-posterior "	26.5 "
	Transverse "	28.5 "
$\mathrm{m}^{\underline{2}}$	Antero-posterior "	26.5 "
	Transverse "	27. "
$\mathrm{m}^{\underline{3}}$	Antero-posterior "	26. "
	Transverse "	19. "

This species, as it now stands, cannot be clearly defined. The type specimen is quite simple in tooth pattern, much more simple than is usual in the teeth of about the same size in the American Museum collection from the Niobrara River locality.

The teeth of the type specimen are little worn and hence the simplicity of the enamel folding is not due to age. A feature shown in this specimen which may distinguish it from the other species of its size is the extreme anterior position of the postpalatal foramen and the anterior extension of the palatal notch. These are placed about 15 mm. farther forward than in any of the Nebraska specimens of the same size in the American Museum collection, and indeed their position is more anterior than in even very young individuals of the domestic horse. However, to make this character a strong distinguishing feature, it would be desirable to obtain several other specimens from the same locality showing this same character.

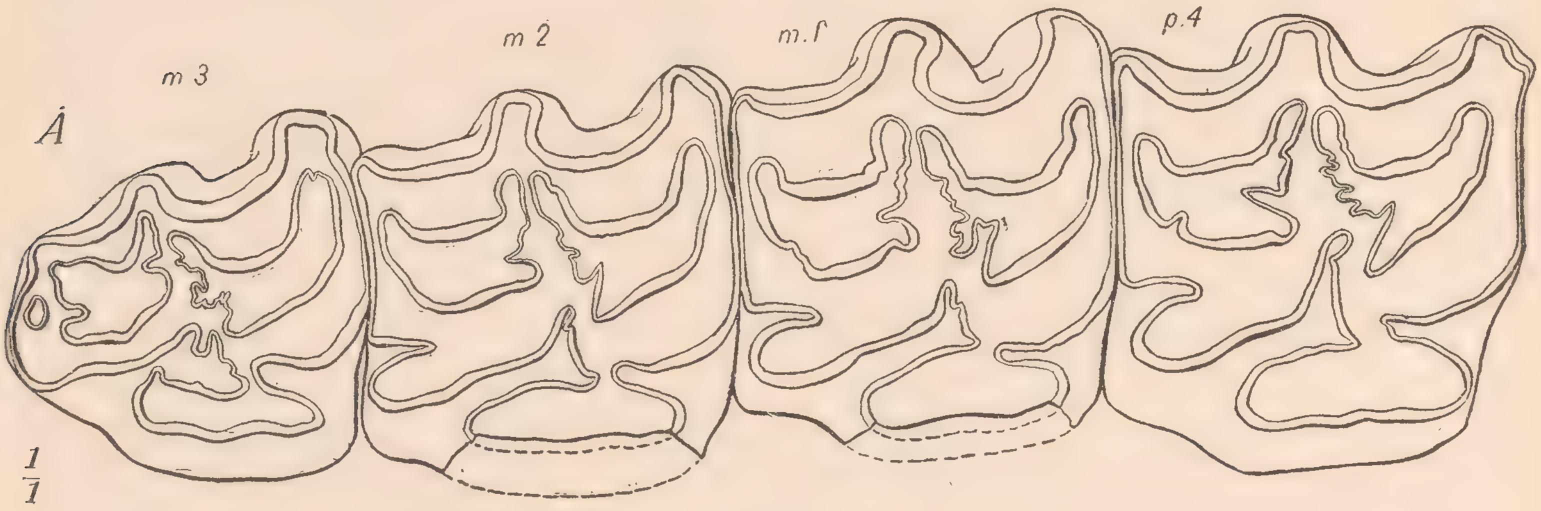
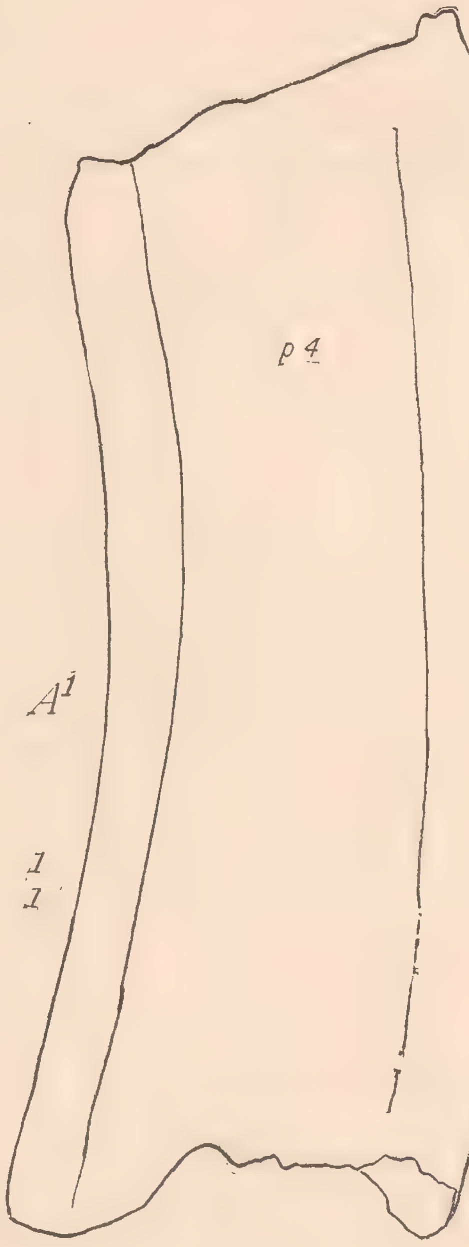


Fig. 9. *Equus excelsus* Leidy. Type. *A*, crown view of upper first, second, and third molars, and fourth premolar. *A*¹, anterior view of p⁴.



(9) **Equus occidentalis** *Leidy.*

Type Locality.—Tuolumne Co., California.

Type.—Superior p³.

Author's Description.—In describing the teeth from California Leidy said: "Two of them are second upper molars of different individuals. . . . These two upper molars, strongly resembling each other, differ from the more recent looking specimens, and from the corresponding teeth of the domestic horse, in the remarkable degree of simplicity of the enamel folding, as seen on the triturating surface."

Measurements given.

Second upper molar (? m^2)	Antero-posterior diameter	— 14¾ lines	(31 mm.).
	Transverse "	— 12½ "	(27 mm.).
" " " (? p^3 Type[1])	Antero-posterior "	15¼ "	(32 mm.).
	Transverse "	13½ "	(28.5 mm.).

This species is apparently undistinguishable from *E. excelsus*, as the type specimens agree in size and both are extremely simple in tooth pattern. However, the Nebraska specimen shows a tendency to a more complicated pattern of enamel folding and may be an extremely simple variation of a species possessing in general more complicated teeth (*E. complicatus*); while an examination of some teeth representing several individuals from the California locality, which have been identified by Leidy as *E. occidentalis*, shows a uniform simplicity of enamel folding. While this is by no means to be considered sufficient ground for retaining the species as separate, there is nothing on the other hand to prove them synonymous, and as they have been named from two widely different localities on opposite sides of the Rocky Mountain system, it is perhaps wisest to retain the two species as distinct for the present.

In 1869[2] Dr. Leidy united these two species on the ground of the absence in both, of the little enamel fold, near the bottom of the deep valley between the protocone and the hypocone. This,

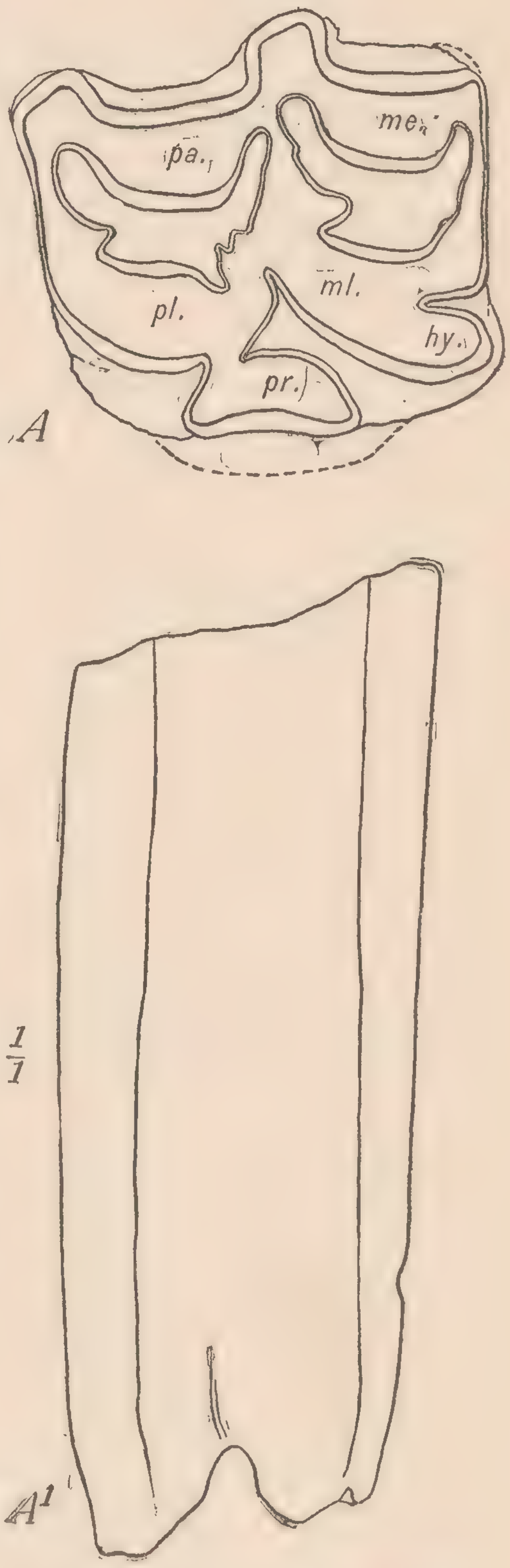


Fig. 10. *Equus occidentalis* Leidy. Type. Superior third premolar. *A*, crown view; A^1, external view.

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[1] This tooth has been chosen as the type inasmuch as it was the one figured.

[2] Extinct Mammalian Fauna of Dak. and Neb., p. 267. When Leidy combined these two species he retained the name *E. occidentalis*, evidently through a mistake in the date of his first description of *E. excelsus*, which he gives as 1868, but which should be 1858.

however, would seem to be scarcely a sufficient reason for uniting them, as, in addition to this being a somewhat variable character, the type specimen of *E. excelsus* shows a deep notch in m$^{\underline{3}}$ and a slight though well marked one in m$^{\underline{1}}$. (The notch in m$^{\underline{1}}$ is not shown in Leidy's figure of the type.)

Professor Cope again separated these two species in 1884,[1] considering them distinct (as he explained in Rept. Geolog. Surv. Texas, 1893), on the untenable ground of the smaller size of the protocone in *E. occidentalis*. Moreover the specimens upon which Cope evidently relied for his characters of *E. occidentalis* were taken from an entirely different locality and undoubtedly belong to a species different from either of the two species under discussion.

(10) **Equus pacificus** *Leidy.*

Type Locality.—Martinez, Contra Costa Co., California.

Type.—Superior p$^{\underline{3}}$.

Author's description.—"The triturating surface in its arrangement of the enamel presents nothing strikingly different from that of the corresponding tooth of the recent horse. As in this there is an inflection of the enamel at the bottom of the principal internal valley, and in this respect and the less simplicity of folding of the enamel islets of the triturating surface differs from *Equus excelsus* of the Niobrara and of California. The tooth probably represents an extinct species, upwards of eighteen hands high. Its measurements are as follows:

Length along the outer median column to the origin of the fangs, 26 lines 56 mm.). Breadth of triturating surface fore and aft, 16½ lines (35 mm.). Thickness independent of cementum, 15 lines (32 mm.)."

Without giving any reason for doing so, Leidy included this species in his list of synonyms of *E. occidentalis* given in 'Fossil Vertebrates,' 1873, p. 322.

It seems altogether likely, however, since *E. pacificus* is so much larger, as is indicated by the tooth measurements, and is more complicated in enamel folding, that it is distinct from *E. occidentalis*. This view is strengthened greatly by an examination of the *Equus* teeth from the Silver Lake, Oregon, locality, which were described by Cope and referred to the species *E. occidentalis*,[1] but which agree exactly, both in size and description, with *E. pacificus* as given by Leidy and are certainly distinct from the specimens described and referred by him to the former species.

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[1] Proc. Am. Phil. Soc., Vol. XXII, 1884, p. 11.

If these Silver Lake specimens can be regarded as representative of *E. pacificus* as described by Leidy, this species can now be pretty clearly defined. Figure 11, *A*, *B*, *C* (Nos. 8601, 8602, and 8603, Coll. Am. Museum Nat. Hist.), are representative teeth of the Oregon collection. Their measurements are as follows:

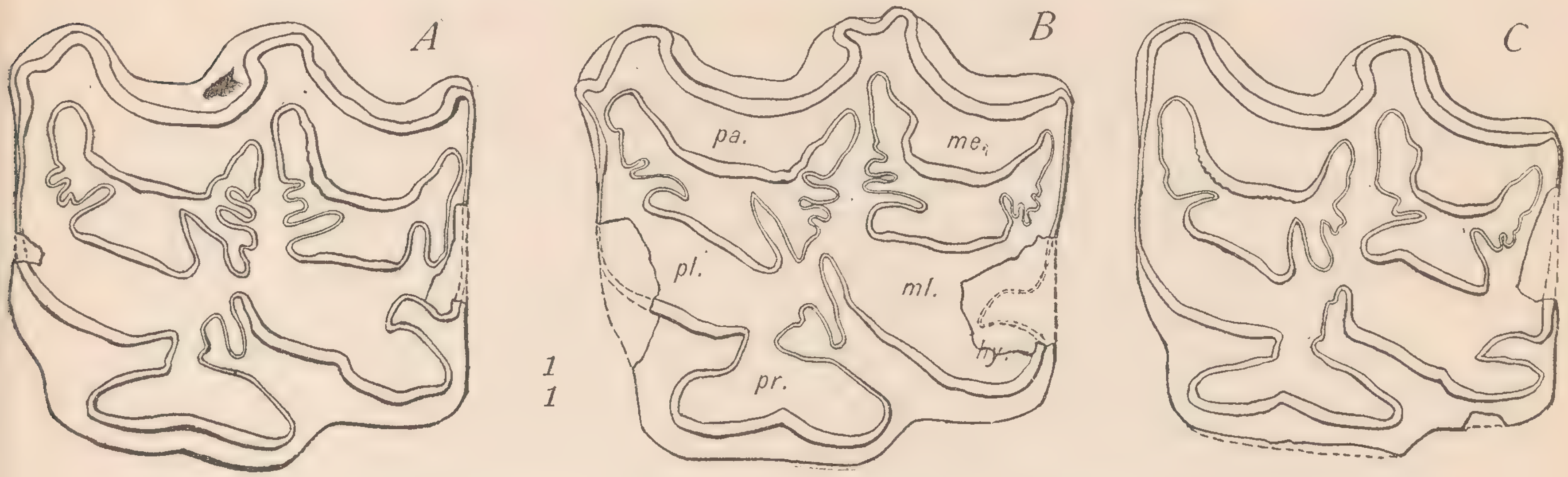

Fig. 11. *Equus pacificus*. *A*, superior fourth premolar, p^4 (No. 8602, Coll. A. M. N. H.); *B*, superior third premolar, p^3 (No. 8601, Coll. A. M. N. H.); *C*, superior second molar, m^2 (No. 8603, Coll. A. M. N. H.)

(No. 8601) p^3	Antero-posterior diameter	35	mm.
	Transverse "	34	"
(No. 8602) p^4	Antero-posterior "	34.5	"
	Transverse "	32.5	"
(No. 8603) m^2	Antero-posterior "	32.5	"
	Transverse "	31	"

The collection above referred to was briefly but not accurately described by Cope. Careful measurements of the bones in this collection show that the astragalus and other bones of the feet that can be identified as fully adult are not smaller than in *E. caballus*, as stated by Cope, but compare in size with the large draught horse. Also he is probably mistaken in the statement that "the inferior canine issues in direct contact with the last incisor, without the diastema seen in the horse." None of the mandibular symphyses in this collection are well enough preserved to show the unbroken alveolar borders and only show that these two teeth were close together or in contact deep down in the jaw. This is often the case in *E. caballus*, but the much greater curvature of the canine brings it to the surface usually some little distance behind the last incisor, leaving a short diastema.

It may be added to the description already given by Cope, (1) that the teeth are actually and proportionally much larger, while the bones of the skeleton about equal in size the larger varieties of *E. caballus;* (2) the occipital region seems to be narrower transversely, and the muzzle, judging from the front portions of lower jaws in the collection, seems to be proportionally shorter.

(12) **Equus conversidens** *Owen.*

Type Locality.—Valley of Mexico.

Type.—A portion of the upper jaw of the right side containing the full molar-premolar series.

Author's description.—In describing the specimens to which he gave the name *E. conversidens*, Owen considered the following to be the distinguishing characters: They correspond closely in "size, curvature, and pattern of the grinding-surface of the upper molar teeth, with *Equus curvidens*. . . . There is "a curved convergence of the two series of upper grinders towards the fore part of the palate to a degree exceeding that in other Equines. . . The last molar, $m^{\underline{3}}$, is relatively smaller than in any old-world Equines. The first premolar, $p^{\underline{2}}$, resembles in the minor production of the anterior lobe that tooth in *Equus asinus*, *Equus quagga*, and differs in this respect from *E. caballus*. The grinding-surface, however, retains, as in *Equus* aff. *caballo*, Ld., and in *E. curvidens*, the general conformity of character of enamel-folding so remarkable in all the modern and in the European Pleistocene Equine species hitherto described. . . . But the most distinctive character of the upper grinders of *E. conversidens* is their disposition in the jaw, denoted by the *nomen triviale* of the extinct Mexican horse; and to the character of the curvature of the molar series of alveoli may be inferentially added a concomitant modification of the shape of the upper jaw itself, involving that of the lower one."

Measurements.

$p^{\underline{2}}$	Antero-posterior	diameter	30 mm.
	Transverse	"	25 "
$p^{\underline{3}}$	Antero-posterior	"	25 "
	Transverse	"	25 "
$m^{\underline{1}}$	Antero-posterior	"	22 "
	Transverse	"	21 "
$m^{\underline{3}}$	Antero-posterior	"	19 "
	Transverse	"	18 "

The principal character upon which Owen based this species is undoubtedly an unnatural feature, not, however, due to distortion, as suggested by Cope,[1] but rather to a placing together of upper jaws of opposite sides of two different individuals. The writer was led to this conclusion by a careful comparison of the corresponding teeth of the opposite sides as shown in Owen's figure of his type specimen. (See Plate XXI, which is a reproduction from the original plate, Phil. Trans., pl. lxi, fig. 1.) An examination of this figure shows that not a single tooth in the one series corresponds at all closely with its opposite in the other series. Not only are the comparative measurements different, but the enamel foldings are so radically different in the corresponding teeth of the two series as to make it very certain that the specimen is a composite of two individuals.

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[1] Proc. Am. Phil. Soc., 1884, p. 13.

A comparison of the two series in any skull of any species of *Equus* will show the reasonableness of this conclusion. These differences, however, are entirely within the range of individual variability and of changes due to age. The relatively shorter antero-posterior diameters of the teeth (especially of m$^{\underline{1}}$ and m$^{\underline{2}}$), the relatively less length of the entire series and the relatively greater posterior extension of the maxillary beyond m$^{\underline{3}}$, all indicate that the series of the left side is of an older individual than that of the right.

Although the principal character assigned to this species by Owen must be disregarded, there remain still enough other characters to define it fairly well. Two of the characters pointed out by Owen, which are shown in both series of his type specimen, seem worthy of consideration, namely, the comparatively small size of m$^{\underline{3}}$ and of the anterior lobe of p$^{\underline{2}}$. Evidently the comparatively small size of m$^{\underline{3}}$ is not due to a little-worn condition of these teeth, as the comparatively small antero-posterior diameters of the other molars, especially in the series of the left side, indicate that it, at least, is of an old individual with all the teeth much worn. Cope seems to suggest, in his article above referred to, that Owen might have taken this character from an imperfectly proportioned photograph of the specimen, for he remarks: "This appearance could be produced by the oblique angle of the aperture of the camera in photographing, due to its too anterior position."[1] This view, however, seems scarcely worthy of consideration, as the other teeth seem to be not at all disproportioned, and had so great a distortion of m$^{\underline{3}}$ been produced m$^{\underline{2}}$ at least would have been affected to a perceptible degree also. Moreover it is evident, from reading Owen's descriptions of the species *E. tau* and *E. conversidens*, that, although, as he states, his descriptions were based on a series of specimens, casts, and photographs sent to him by the Engineer of Mines, Mexico, he must have had either the cast or the specimens themselves, upon which he founded the species *E. conversidens*, and from which he took his characters and measurements; for he mentions at the beginning of his description (see p. 118) that, among other features, the curvature of the molar teeth corresponds closely with *E. curvidens*, and this character could not possibly be made out from a photograph showing only the crown view.

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[1] Proc. Acad. Sci. Phila., 1884, Vol. XXII, p. 13.

Thus, then, the two characters above mentioned, together with its smaller size and geographical location, seem to determine this species fairly well.

(13) **Equus tau** *Owen.*

Synonym, *Equus barcenæi* Cope.

Type Locality.—Valley of Mexico.

Type.—A superior molar-premolar series lacking $p^{\underline{2}}$.

Author's description.—" They [the teeth] are as much smaller than the corresponding teeth of *Equus conversidens* as are those of the *Asinus fossilis* from the Oreston Cavern (History of British Fossil Mammals, p. 396, figs. 157, 158) compared with the teeth of *Equus plicidens* from the same cavern, and they indicate a species about the size of the common Ass.

" As compared with any of the smaller existing kinds of Equines the antero-posterior diameter of the grinding-surface of the crown, especially in the premolars, is in excess; and in this character *Equus tau* also differs from *Equus conversidens*, as it does in the greater relative size, especially antero-posterior breadth, of the last molar $m^{\underline{3}}$: *E. tau* further differs in the greater flattening, from without inward, of the inner lobe of most of the molars."

Unfortunately Owen did not give any measurements with this description, but if his figure of the type specimen is sufficiently accurate to be relied upon, as seems quite probable from the exactness of his other figures, the measurements may be given as follows:

p^3	Antero-posterior diameter	22.5 mm.
	Transverse "	19 "
$p^{\underline{4}}$	Antero-posterior "	23 "
	Transverse "	20 "
$m^{\underline{1}}$	Antero-posterior "	21 "
	Transverse "	19.5 "
$m^{\underline{2}}$	Antero-posterior "	21.5 "
	Transverse "	18 "
$m^{\underline{3}}$	Antero-posterior "	22 "
	Transverse "	15.5 "

This species is much the smallest of any described from America. Owen considered it about the size of the common Ass, but it is much smaller than that species, *E. conversidens* and *E. asinus* being much more nearly of a size (see Table I, p. 98).

In his paper on 'The Extinct Mammalia of the Valley of Mexico'[1] Cope united *E. conversidens* with *E. tau*, retaining the latter name. Why he did so, he does not explain, except that he says, "I could detect no specific differences between the seven or eight specimens I examined." As Cope expressed considerable doubt as to the identity of the type specimens, especially of *E. tau*, it seems quite probable that the true type of this species was never in his hands, and his description of *E. tau* was probably based upon specimens that properly belonged to *E. conversidens*.

There is a superior molar tooth, m^2 (No. 9211), in the collection of the American Museum from Peace River, Florida, which is much too small to be referred to any species reported from the United States. A second tooth from Lookout Mountain, Tennessee, recently presented to the American Museum by Mr. E. S. Hallock, agrees almost exactly in size and character with the Florida tooth. These two teeth represent a very small horse once inhabiting the south-eastern part of the United States, which in point of size did not differ materially from *E. tau* of the Mexican Valley. Hence as there are no characters

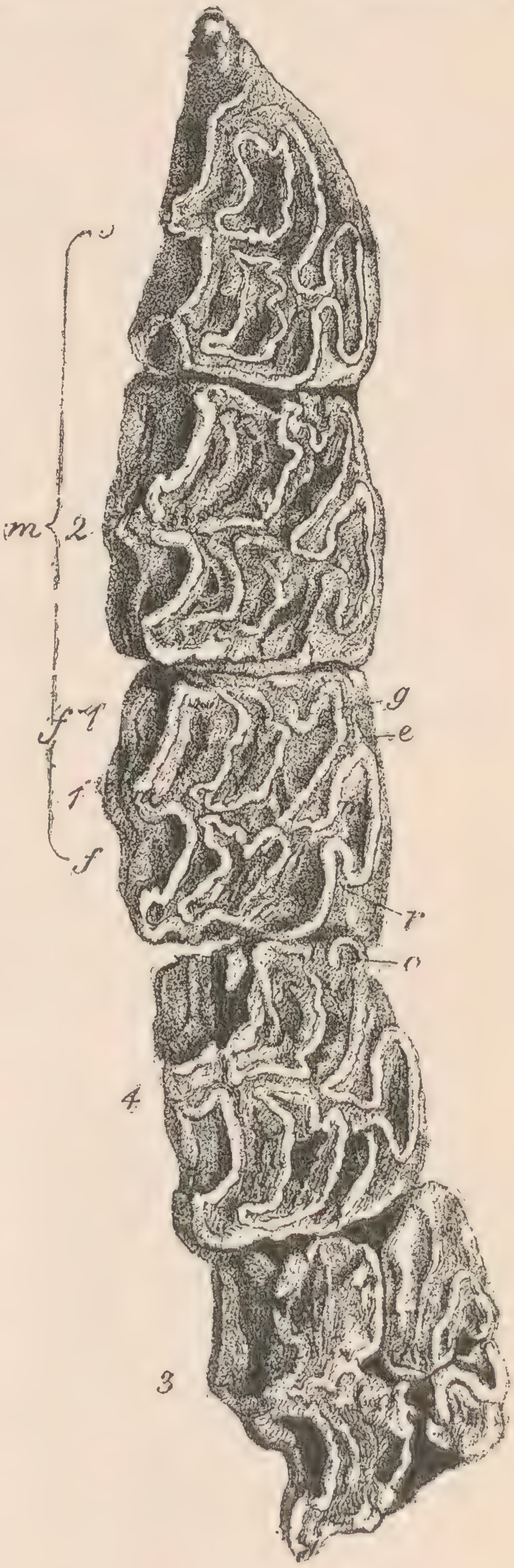

Fig. 12. *Equus tau* Owen. Type. Upper molar-premolar series, lacking second premolar, p^2. (After Owen.)

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[1] Proc. Am. Phil. Soc., Vol. XXII, 1884, pp. 12, 13.

in the teeth above mentioned to distinguish them from *E. tau* they should provisionally be referred to this species, although the two localities are so widely separated. Future discoveries may prove that the teeth from the southeastern United States belong to a distinct species.

(14) *Equus crenidens* Cope.

Type Locality.—Tequixquiac, Valley of Mexico.

Type.—Fragment of upper jaw containing the premolars of one side.

Author's description.—"This species is primarily distinguished by the close and strong wrinkling of the enamel border of the lakes of the superior molar teeth. This wrinkling, or vertical plication, reminds one of what is seen in the *Elephas indicus.* This wrinkling is not found in the enamel edges which border the interior crescents on the inner side, nor in those bordering the internal lobes or columns. The borders of the lakes are not folded in the complex loops seen in *Equus major* Dek., but have the plainer looping seen in *Equus tau* Ow The grinding faces are nearly square. . . . The crimping of the enamel of the lakes distinguishes this species from the others of the genus."

Measurements given.

$p^{\underline{2}}$	Antero-posterior diameter	43	mm.
	Transverse "	30.5	"
$p^{\underline{3}}$	Antero-posterior "	33.5	"
	Transverse "	34	
$p^{\underline{4}}$	Antero-posterior "	31	'
	Transverse "	35	"

Although a minute description and measurements have been given, this species appears to be indeterminate. As seems usually to have been his custom, Cope has given the transverse measurements of the teeth, including the cement, hence they are not of much value except in as far as they show that the type of *E. crenidens* is of a large horse, apparently about the size of *E. pacificus* or the somewhat smaller *E. scotti.* The crimping of the enamel which Cope seemed to consider the distinguishing character is probably not more than an exaggeration of the same character often indicated in the premolars of *E. caballus.* That Cope himself did not place great reliance on this character is evidenced by the fact that he afterward described and figured a large tooth from southwestern Texas,[1] referring it to this species, which shows no uncommon tendency to any such wrinkling. This tooth, however, from its enormous size evidently belongs to a species much larger than the Mexican specimen which Cope called *E. crenidens*, or even the large *E. pacificus*.

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[1] Am. Nat., 1885, p. 1208, fig. 4 (No. 8616, Am. Museum Nat. Hist., Cope Coll.).

(15) *Equus barcenæi* Cope.

Type Locality.—Valley of Mexico.

Type.—Two superior molars.

Author's description.—" This horse is distinguished from all the others here mentioned or described by its small size. In the characters of its superior molars it is like the *Equus excelsus*. The anterior internal column is flat, and its antero-posterior diameter is five-eighths that of the crown of the tooth. The prism is straight. The lakes have the margin but little looped; the posterior notch of the anterior lake is trebled or triplex. The grinding face of the crown of the third superior molar is a little longer than the others."

Measurements.

Diameters of molar No. 1.	Antero-posterior	21.5 mm.
	Transverse	23 "
Diameters of molar No. 2.	Antero-posterior	22 "
	Transverse	22 "

In 1893[1] Cope made this species a synonym of *E. tau*. It is difficult to make out whether, in doing so, he referred to *E. tau* Cope (not of Owen),[2] which has been shown to be the equivalent of *E. conversidens*, or whether he now regarded *E. tau* in the light of the original description given by Owen. It seems probable, however, that the latter view is the correct one, as in this connection he referred to Owen's description of *E. tau* and not to his own. Taking into account the fact that the transverse diameters of the teeth of *E. barcenæi* given by Cope probably include the cement, there seems to be no distinction between this species and *E. tau* Owen, and therefore it may be considered, as Cope has already placed it, a synonym of this species.

(16) **Pliohippus simplicidens** *Cope.*

Equus simplicidens Cope.

Type Locality.—Mt. Blanco, Texas.

Horizon.—Blanco Beds (Upper Pliocene).

Type.—Superior molar.

Author's description.—" The size of the teeth is about that of the *E. occidentalis* and *E. caballus*. The internal column is of moderate antero-posterior extent, its posterior border marking the anterior third of the posterior lake. Its long diameter is considerably less than half that of the crown. A peculiarity found in two of the superior molars, but not in two others, is that the median dental connection between the external and median crescents is interrupted by the continuity of the enamel plates bordering the lakes from the one to the other. This arrangement is frequently seen in the large $pm\frac{2}{}$, in the species of *Equus*, but does not occur in the other premolars and molars. It is a reversion to the condition seen in *Anchitherium*. A principal character of the species is seen in the extreme simplicity of the enamel borders of the lakes."

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[1] Report Geol. Surv. Texas, 1893, p. 79.

[2] Proc. Am. Phil. Soc., 1884, p. 12.

Measurements not given.

This species was founded upon exceedingly doubtful characters, all the characters given in the above description being apparently due to the little-worn condition of the tooth. (See Fig. 2, *C*, *D*, and discussed p. 95.) However, the validity of the species is somewhat strengthened by Cope's description and figures of additional specimens from the same locality,[1] and from the fact that it seems to be the only large horse so far discovered in this geological horizon.

It seems exceedingly doubtful, however, whether this species can be properly placed in the genus *Equus*. Cope did not point out or suggest any characters that mark it as belonging to this genus, nor are there any such characters shown in any of his figures. On the contrary, there are in his descriptions and figures, and also in three teeth collected by the writer from the same locality (No. 10624, Am. Mus. Nat. Hist. Collec.) and probably belonging to the same species, several indications of primitive characters linking this species much more closely with *Pliohippus*, as this genus is understood, than with *Equus*. The character of the very small protocone and the tendency to a sharp entrant-angular groove between the metaconid and metastylid columns, a distinguishing character given by Cope[1] for the lower teeth, are both like the Loup Fork genera and unlike any of the Pleistocene or recent species of *Equus*. Besides these characters the American Museum specimens show other characters which seem

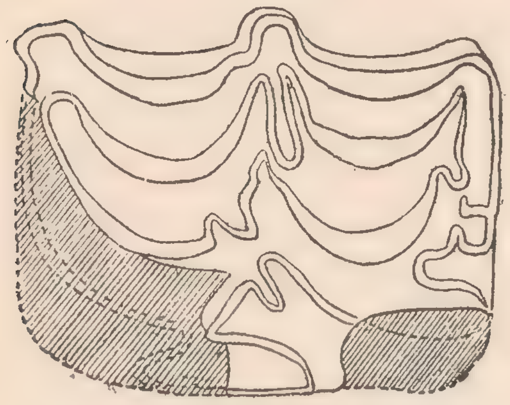

Fig. 13. *Pliohippus simplicidens*. Type. (*Equus simplicidens* Cope). Superior premolar. (After Cope.)

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[1] Report Geol. Surv. Texas, 1893, p. 66.

to indicate the close relationship of this species to the more primitive genera of the Loup Fork. The little outward folding of the enamel at the antero-external border of the protoconid, so generally observed in all the Loup Fork genera, is plainly indicated in the two lower teeth by a well-marked groove. This peculiar fold of enamel, which is entirely wanting in the genus *Equus*, seems to be a primitive character and apparently was derived, in the evolution of the tooth, from the anterior cingulum of the more primitive brachydont tooth in passing to the hypsodont form. Although these teeth are of an old individual and are pretty well worn, they have the appearance of being of a very short-crowned pattern.

This species is about the size of *Pliohippus mirabilis* Leidy.

(17) **Hipparion eurystylus** (*Cope*).

Equus eurystylus Cope.

Type Locality.—Paloduro Cañon, Texas.

Horizon.—(?) Goodnight Beds.

Type.—Lower molar.

Author's description.—"This species belongs with *E. minutus* Cope, to a section of the genus characterized by the relatively great width of the metaconid-metastylid column of the inferior molars, and its close appression to the protoconid and hypoconid, and hence by the relatively narrow molar crown ; and also by the small size." (For further description see Report Geological Survey of Texas, 1893, pp. 44, 45.)

Measurements given.

Specimen No. 2 (Cope)	Longitudinal diameter	55 mm.
	Antero-posterior "	24 "
	Transverse "	10 "
Specimen No. 5 (Cope)	Longitudinal "	40 "
	Antero-posterior "	22 "
	Transverse "	12 "

None of the characters given in Cope's very minute description of this species, or shown in his figures, prove any relationship to the genus *Equus* ; but they all seemingly show its positive identity with or at least its very close relationship to the three-toed horses of the Loup Fork.

An examination of the horse teeth from the true Loup Fork Beds (in the American Museum collections) indicates that the character of "the relatively great width of the metaconid-metastylid column of the inferior molars" is only a feature of individual variability, as this column is very variable in size. The characters that seem to point most strongly to the association of this species with the genus *Hipparion* are as follows: (1) The appression of the metaconid-metastylid column to the protoconid and hypoconid, which seems to be characteristic of *Protohippus* and *Hipparion* and not of *Equus;* (2) the presence of a well-defined enamel keel or loop in the anterior border of the protoconid; (3) the greater extension of the transverse ridge of enamel thrown out from the parastylid, which extends beyond the middle and usually to the outer edge of the metaconid, and marks the antero-internal corner of the tooth in *E. eurystylus* and all the three-toed horses; and which in *E. caballus* and the fossil species of *Equus* seems seldom to extend beyond the middle of the metaconid and often only as far as its inner margin:

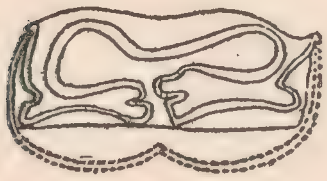

Fig. 14. *Hipparion eurystylus.* Type of *Equus eurystylus* Cope. Superior premolar. (After Cope.)

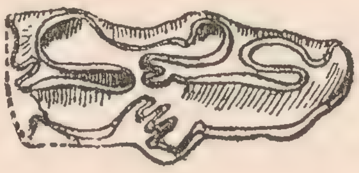

Fig. 15. *Hipparion eurystylus* (*Equus eurystylus* Cope). Lower molar. (After Cope.)

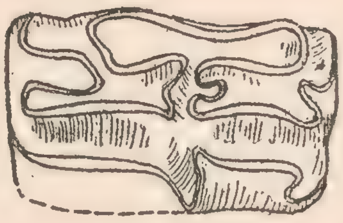

Fig. 16. *Hipparion eurystylus* (*Equus eurystylus* Cope). Lower premolar. (After Cope.)

(1) The tendency toward flat external faces of the protoconid and hypoconid, and (2) toward the formation of the external median keel, mentioned by Cope, together with its size, seem definitely to place this species in the genus *Hipparion.* (Compare Cope's figures of *E. eurystylus* with Leidy's figures given in 'Extinct Mammalia of Dakota and Nebraska,' Pl. xix, figures 4, 6, 10, 31, 34, 37, and 40.) The specific distinctions apparently cannot be made out.

(18) **Protohippus cumminsii** (*Cope*).

Equus cumminsii Cope.

Type Locality.—Mt. Blanco, Texas.

Horizon.—Blanco Beds.

Type.—Superior molar.

Author's description.—"The enamel borders are entirely simple. . . . It differs from the *E. simplicidens* and *E. tau* in the prominent concavity of the internal wall of the paracone and metacone, from which it results that the exterior border of each of the lakes is deeply concave, and the horns appear to be strongly produced. The protocone has a very short antero-posterior diameter, in which it resembles the *E. simplicidens*, *E. crenidens*, and *E. stenonis*, and differs radically from the *E. tau* and the other species of the Equus beds. It is not bilobate or grooved on the internal face. . . . The subcylindric character of the paracone and metacone approach what exists in 'Hippidium' and some species of the three-toed horses."

Measurements given.

The measurements of the best-preserved crown are: length, 33 mm.; transverse diameter, 24 mm.; antero-posterior, 24 mm.

This species was founded on three superior molars, two of which were figured by Cope. (See Figure 17.) Both the description and the figures show some characters that seem to mark its close relation with the three-toed horses, and like those given by Cope for the distinction of his *E. eurystylus* and *E. simplicidens* they show no characters that indicate any connection with the genus *Equus*. The very small size and form of the protocone seems especially to identify this species with the Loup Fork genera, and its extreme simplicity of enamel folding of the tooth crown seems to place it in the genus *Protohippus*.

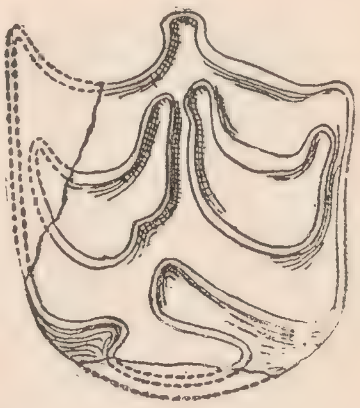

Fig. 17. Type of *Protohippus cumminsii* (*Equus cumminsii* Cope). Superior molar. (After Cope.)

(19) **Protohippus phlegon** (*Hay*).

Equus phlegon Hay.

Synonym, *Equus minutus* Cope.

Type Locality.—Mount Blanco, Texas.

Horizon.—Blanco Beds.

Type.—An inferior molar—(?) $m_{\overline{2}}$.

Author's description.—"The inferior molar is narrowly hypsodont, and has apparently had but a thin cementum investment. . . . The inner side of the crown shows marked peculiarities. The metaconid and metastylid are appressed to the hypoconid and protoconid, and are spread widely apart so as to be connected by a narrow antero-posterior isthmus, and separated on the internal face of the crown by a wide channel which has a greater antero-posterior diameter than the metaconid and metastylid respectively, near the apex of the crown, and an equal width at the base of the crown. The hypostylid (entoconid) is also appressed to the hypoconid and has a recurved postero-internal angle, which forms an acute ridge bounding the internal face of the crown posteriorly. This encloses with the metastylid a flat open gutter as wide as the metastylid. A sharp ridge marks the internal face of the anterior border, but it is closely appressed to the metaconid, which it does not equal in elevation."

Measurements given.

Length of crown preserved	37	mm.
Antero-posterior diameter at middle	16.5	"
Transverse diameter at metastylid	8	"
Transverse diameter in front of metastylid	6	"

This tooth shows the same characters pointed out in Cope's *E. eurystylus* to distinguish it from the genus *Equus* except that the little fold of enamel at the anterior border of the protoconid is wanting. A comparison of Cope's figure (reproduced in Figure 18, and Figure 19 which represents a corresponding lower molar of *Protohippus*, No. 10579, Coll. Am. Mus.,) shows the very close relationship of the species to which the teeth represented by these figures belong, and were it not for the little enamel fold mentioned above, in the one, they would undoubtedly be referred to the same species if their different localities were not known. In a series of five lower teeth (No. 10626, Coll. Am. Mus.) of this species, found in the exact locality in the Blanco beds from which Cope's type specimen was taken, the same general Protohippus-like characters are shown as in the type tooth, and a rudiment of the enamel fold of the protoconid is shown in all of them.

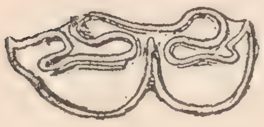

Fig. 18. Type of *Protohippus phlegon* (*Equus minutus* Cope). Lower molar. (After Cope.)

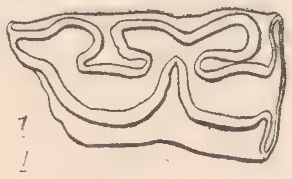

Fig. 19. Lower molar of *Protohippus sp.* (Loup Fork).

Very unfortunately, an upper molar, found by the writer in the same locality a few days before the finding of the lower teeth, was lost. This tooth agreed in size with the lower teeth and could not have been distinguished from *Protohippus*. The crown was not much worn and the little oval protocone was still quite separated from the protoconule.

The species distinctions of this little horse of the Blanco beds apparently cannot be defined, unless the rudimentary condition of the anterior outward fold of enamel of the protoconid should prove to be constant and thus separate it from the species of *Protohippus* from the true Loup Fork beds.

(20) **Equus semiplicatus** *Cope.*

Type Locality.—Rock Creek, Brisco Co., Texas.

Horizon.—Sheridan Beds.

Type.—Superior molar $m^{\underline{2}}$ (?).

Author's description.—"These teeth indicate a species of about the dimensions of the *E. tau*, but characterized by a greater complexity of the enamel foldings. . . . In all the Texas specimens the antero-posterior diameter of the protocone is more than half that of the grinding face of the crown. This places the *Equus semiplicatus* in the same group as the *E. excelsus* and *E. tau.* From the former its inferior size distinguishes it, as well as the closer plications of its enamel borders. . . . The characters of the grinding face resemble those of the *E. conversidens* Owen, as far as the latter can be understood from Owen's figures. But in this species, according to Owen, the crowns are transversely curved, while in *E. semiplicatus* they are straight."

Measurements given.

Diameters superior molar (Tule Cañon)	Antero-posterior	25 mm.
	Transverse	25 "
Diameters superior molar (sp. from San Diego)	Antero-posterior	25 "
	Transverse	27 "

A comparison of the measurements will show that the teeth of this species are very much larger than those of *E. tau*, and are even larger than those of *E. conversidens* as given by Owen. The species seems to be about intermediate in size between *E. complicatus* and *E. conversidens*, and is about the size of *E. fraternus.* Its tendency to a very simple tooth pattern, however, seems to distinguish it from the latter species.

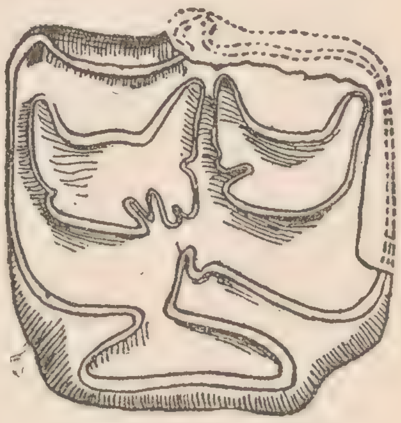

Fig. 20. *Equus semiplicatus* Cope (type). Superior molar. (After Cope.)

A skull from southwestern Texas, now in the American Museum collection (No. 8600), which Cope had previously described and referred to *E. excelsus*,[1] and which was again mentioned and figured in his Rept. Geological Survey of Texas, p. 81, Pl. xxii, Fig. 3, differs not at all from Cope's description, measurements, and figures of *E. semiplicatus*, but does differ in both size and general character from Leidy's type of *E. excelsus.* Also, coming from practically the same locality as the type specimen of *E. semiplicatus*, and from the exact locality from which two of the paratypes were collected, it seems to belong more properly to the latter species than to *E. excelsus.*

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[1] Am. Naturalist, 1891, p. 912.

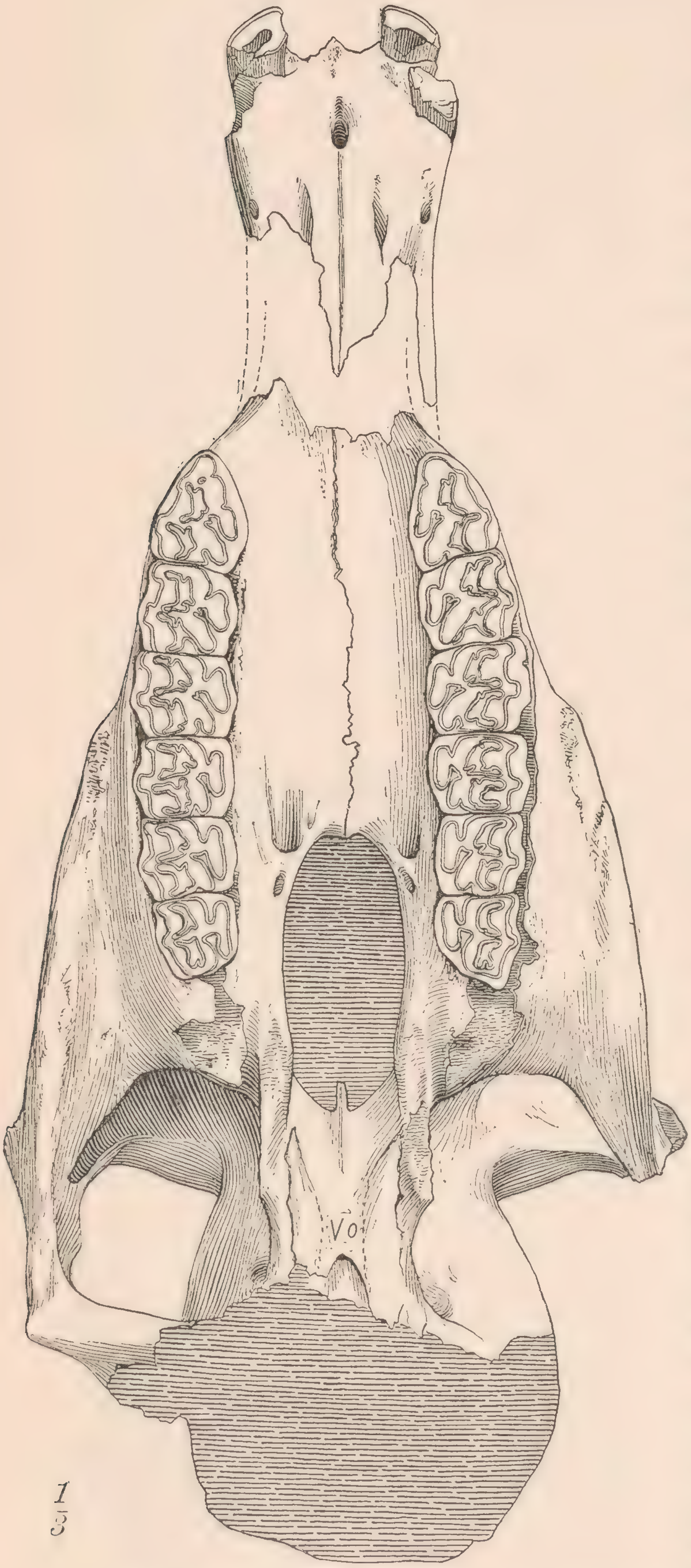

Fig. 21. Skull of *Equus semiplicatus* (No. 8600, Coll. A. M. N. H., San Diego, Texas). Palate view.

This skull has been fully described by Cope as above cited. A character mentioned by Cope in this description, that of the posterior prolongation of the vomer over the presphenoid, (Fig. 21) a character in which it resembles the ass, seems distinctly to separate this species from all the others of the Pleistocene in which this character is known, they being like *E. caballus* in this respect.

(21) *Equus intermedius* Cope.

As this term is preoccupied, Hay substituted for it the term *E. eous*.

Type Locality.—Petite Anse, Louisiana.

Type.—Fragment of maxillary containing the three molars and two premolars, p^3 and p^4.

Author's description.—Cope's description of this species is given at considerable length, and as much of it is a discussion of characters that have no standing, only the most important of the characters mentioned will be repeated here. "The molar teeth are as large as those of the *E. major* and large forms of the common horse. The enamel folds are less complex than those of the former, but are more complex than is usual in the *E. caballus*. . . . A transverse crest connects the paroccipital processes and the basisphenoid, bounding the precondylar fossa in front, so as to convert it into a basin. . . . The *E. intermedius* is a shorter-nosed species than the *E. caballus*, the distance from the anterior lower premolar forwards only equalling the corresponding length in the quagga, while the parts are in other respects as large as those of the domestic horse."

Measurements given for the teeth.

Diameters of $p^{\underline{2}}$	Antero-posterior	30 mm.
	Transverse	31 "
Diameters of m^{1}	Antero-posterior	25 "
	Transverse	30 "
Diameters of $m^{\underline{3}}$	Antero-posterior	36 "
	Transverse	29 "
Length of mandible from $pm^{\underline{3}}$ to external border of incisors		130 "

Measurements of occipital condyles.

Transverse diameter	92 "
Antero-posterior diameter above	50 "

The specimens upon which Cope founded this species, as above mentioned (see *E. complicatus*, page 110), were considered by him identical with a certain other lot of specimens from the same locality which had been referred by Leidy to *E. major* (*E. complicatus*),[1] but which he thought could not be identified with that species; separating them on the ground of the less complexity of the enamel folding in these teeth than in those of *E. complicatus*.

One of the specimens, at least, figured by Leidy in the work above cited is more complicated in tooth pattern than is indicated by the figure of his type specimen of *E. complicatus*, and the specimens described by Cope seem not to differ at all in this respect from the *E. complicatus* type. But even if this lot of teeth described by Cope are somewhat simpler, a character so variable as this one seems hardly sufficient grounds for founding a new species. The specimen figured by Cope (see Cope's figure[2]) shows every indication of belonging to an old individual, which would account for much of the simplicity of these teeth. Cope attempted no other distinction, nor does there seem to be any. On the other hand there seem to be good reasons for considering the two species as identical. There seems to be no difference in size and practically no difference in tooth pattern; the type specimens come from practically the same locality, the type localities being less than one hundred miles apart; therefore as there seems to be absolutely nothing upon which to separate these species, there is no alternative but to consider *E. eous* (*E. intermedius* Cope) a synonym of *E. complicatus*, and the very good characters given by Cope for his species should be considered additional characters which clearly define the species *E. complicatus*.

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[1] Trans. Wagner Free Inst. of Sci., 1889, p. 38.

[2] Proc. Am. Phil. Soc., 1895, Pl. ix, Fig. 8.

E. complicatus, as thus understood, seems to be the common species of Pleistocene times in the United States; its geographical distribution extending over a wide area east of the Rocky Mountains and south over the Gulf States, and perhaps along the Atlantic coast as far north as New Jersey; though the specimens reported from this region cannot be certainly identified, the material consisting only of single teeth. In the collections from the Niobrara River there are a great number of jaws, skull fragments and bones, which from their size and general characters evidently belong to this species. The specimen represented by Pl. XVIII, Fig. *B* (No. 2725 Am. Mus. Coll.) is typical of the horse

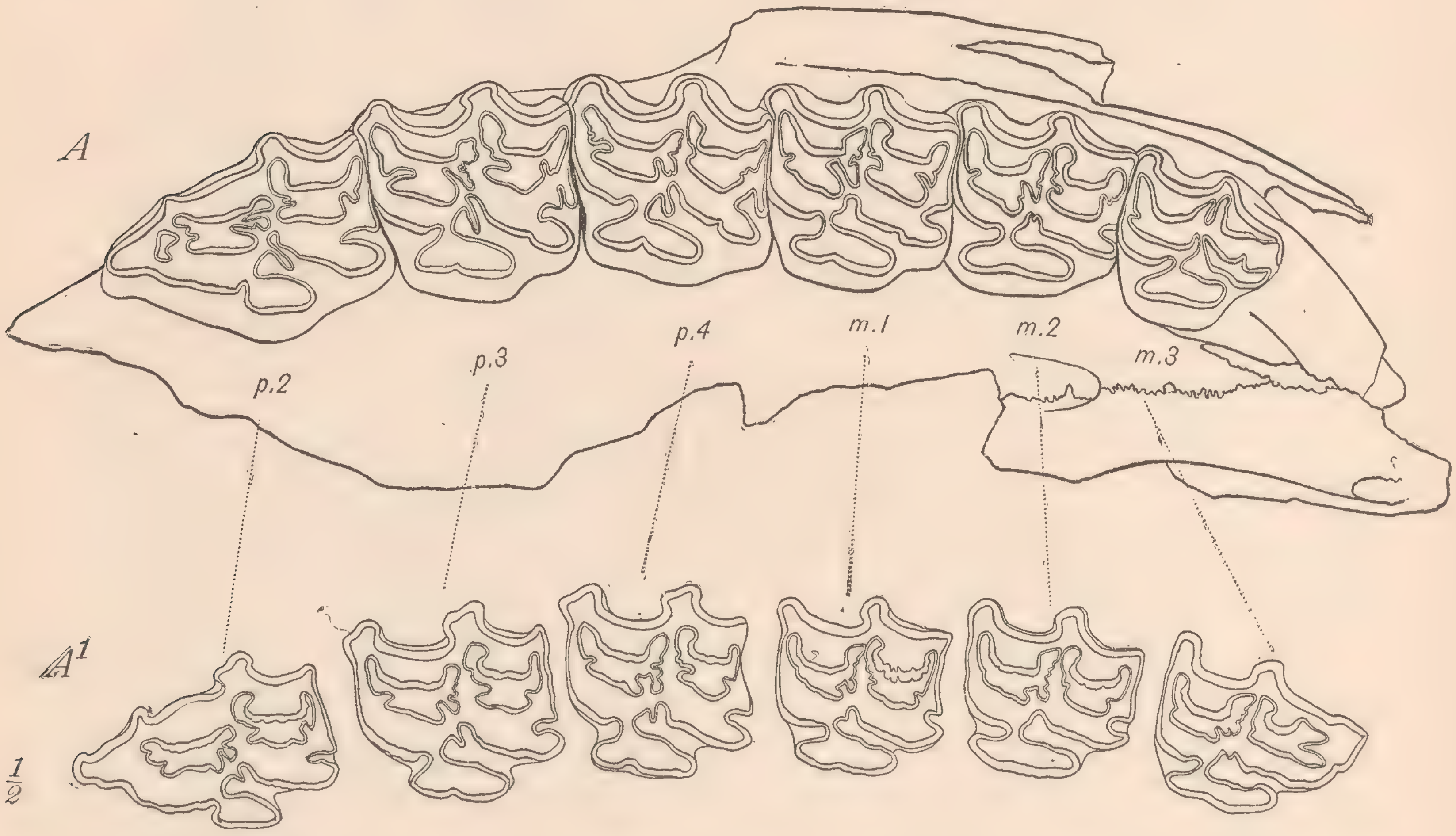

Fig. 22. *E. complicatus*. (Tule Cañon, Texas.) Superior molar-premolar series of right side sectioned to show change in teeth due to wear. *A*, triturating surfaces; *A*¹, sections cut parallel to the triturating surface about the middle of the crowns. (No. 10611, Coll. A.M.N.H.).

of its size from the Niobrara locality. It shows the comparatively short muzzle and the characters in general pointed out by Cope in his description of *E. intermedius.* This specimen represents a young animal with the last molar only just coming into full use, hence the differences in this region compared with Cope's figures. Several symphyses mandibuli containing the incisors, as well as the lower jaw belonging with the specimen above figured show the absence or extensive interruption of the internal wall of the external incisor. Three occiputs in this collection also show the characters pointed out by Cope for his *E. intermedius*, and agree very well with the measurements given. A series of teeth in a portion of the maxillary (Fig. 22) and two fragments of lower jaws (Nos. 10600, 10601, Coll. Am. Mus.), besides a few single teeth, represent this species from the Tule Cañon and Rock Creek, Texas, locality. Leidy reported and figured some teeth from Hardin Co., Texas, which he referred to this species. These teeth, now in the American Museum (Nos. 8617–8618), do not differ in any way from the corresponding teeth in the specimens from the Staked Plains and Nebraska.

(22) **Equus pectinatus** (*Cope*).

Type Locality.—Port Kennedy, Penn.

Horizon.—Megalonyx Beds. (Cave deposits).

Type.—Nine superior molars and premolars probably belonging to one individual.

Author's description.—In describing some *Equus* teeth from Port Kennedy, which he considered as represending two varieties of *E. fraternus*, Cope gave the following as distinguishing characters: "The superior molar teeth all agree in the fact that the antero-posterior diameter of the protocone enters the same diameter of the entire crown from two and a third to nearly three times. . . . In other Plistocene horses of North America, the antero-posterior diameter of the protocone is from one-half to three-fifths that of the entire crown, excepting in the premolars of *Equus occidentalis* Leidy, and in the large *E. crenidens* Cope. . . . One of the individuals differs from the other in the greater complexity of the enamel plates, especially on the opposed faces of the external lakes, agreeing in this respect with *Equus complicatus* of Leidy. . . . The superior molars displaying moderate complexity are of smaller size than the complex ones. . . . Under the circumstances it is necessary to distinguish two races of *Equus fraternus* as already indicated: *E. f. fraternus* and *E. f. pectinatus*, which may prove to be distinct species."

Measurements[1]:

Diameters	$p^{\underline{3}}$	Antero-posterior	32	mm.
		Transverse	30	"
"	$p^{\underline{4}}$	Antero-posterior	29	"
		Transverse	29	"
"	$m^{\underline{1}}$	Antero-posterior	26	"
		Transverse	29	"
"	$m^{\underline{2}}$	Antero-posterior	27	"
		Transverse	27.5	"
"	$m^{\underline{3}}$	Antero-posterior	34	"
		Transverse	25	"

The Port Kennedy specimens seem to represent two distinct species as suggested by Cope; however, it seems highly improbable that either bears any close relationship with the South Carolina species, *E. fraternus*, which is one of the smallest American species, while *E. pectinatus* is large, comparing in size with *E. complicatus* or *E. scotti.* The teeth of the type specimen are much worn, yet they show an unusual degree of complication in the enamel foldings (see Fig. 23). As pointed out by Cope the protocones of the type specimen are unusually small. The skull characters are not known and until they can be made out this species cannot be clearly defined. Leidy described and figured some teeth from Illinois[2] (see Fig. 24) which he referred to *E. complicatus*, but which seem to agree more closely with *E. pectinatus.*

The other Port Kennedy teeth described by Cope and identified with *E. f. fraternus* seem not to differ essentially from *E. complicatus* although they are somewhat smaller.

(25) **Equus scotti** *Gidley.*

Type Locality.—Rock Creek, Brisco Co., Texas.

Horizon.—Sheridan Beds.

Type.—Part of a skeleton (No. 10,606), including the skull and lower jaws, all the cervical and the three anterior dorsal vertebræ, both fore limbs and feet complete, one hind limb and foot complete, and several dorsal and lumbar vertebræ and ribs probably belonging with it.

Author's description.—Compared with *E. caballus*: (1) The skull is relatively larger, (2) the teeth are relatively larger compared with the skull, (3) the neck is shorter, (4) the body is longer, (5) the limbs are shorter and more

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[1] The measurements given by Cope include cement, hence the writer has carefully remeasured the teeth and substitutes here these measurements for those given by Cope.

[2] Trans. Wagner Free Inst., Phil. Vol. II, 1889, p. 39.

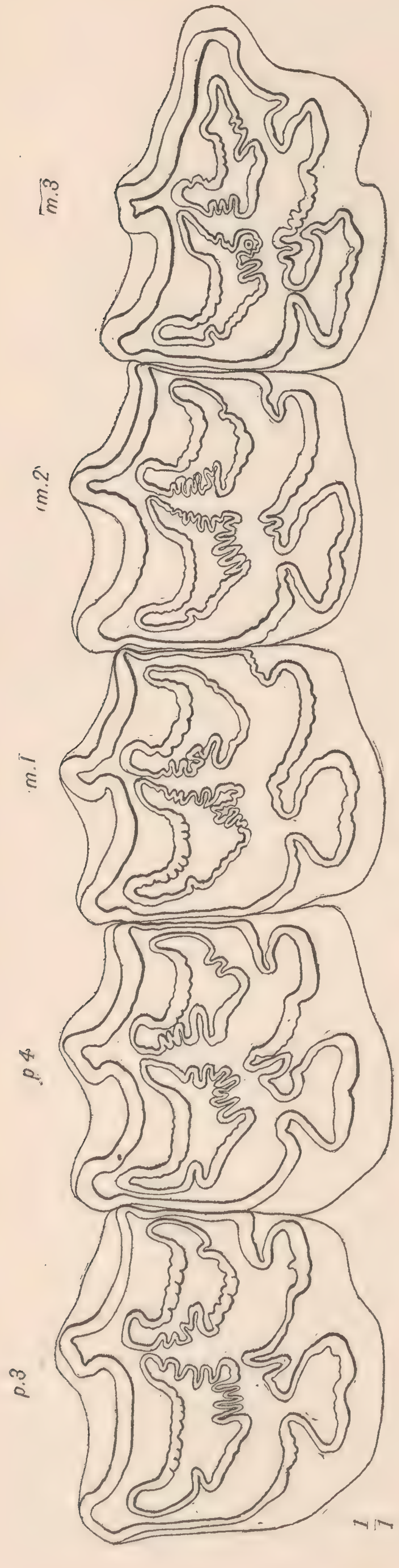

Fig. 23. *Equus pectinatus* Cope. Type. Superior molars m^1, m^2, and m^3, and premolars, p^3 p^4.

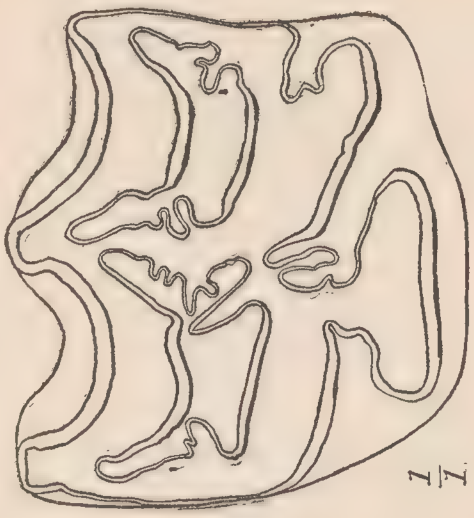

Fig. 25. *Equus scotti.* Superior molar, m^1 of type skull (No. 10606, Coll. A. M. N. H.)

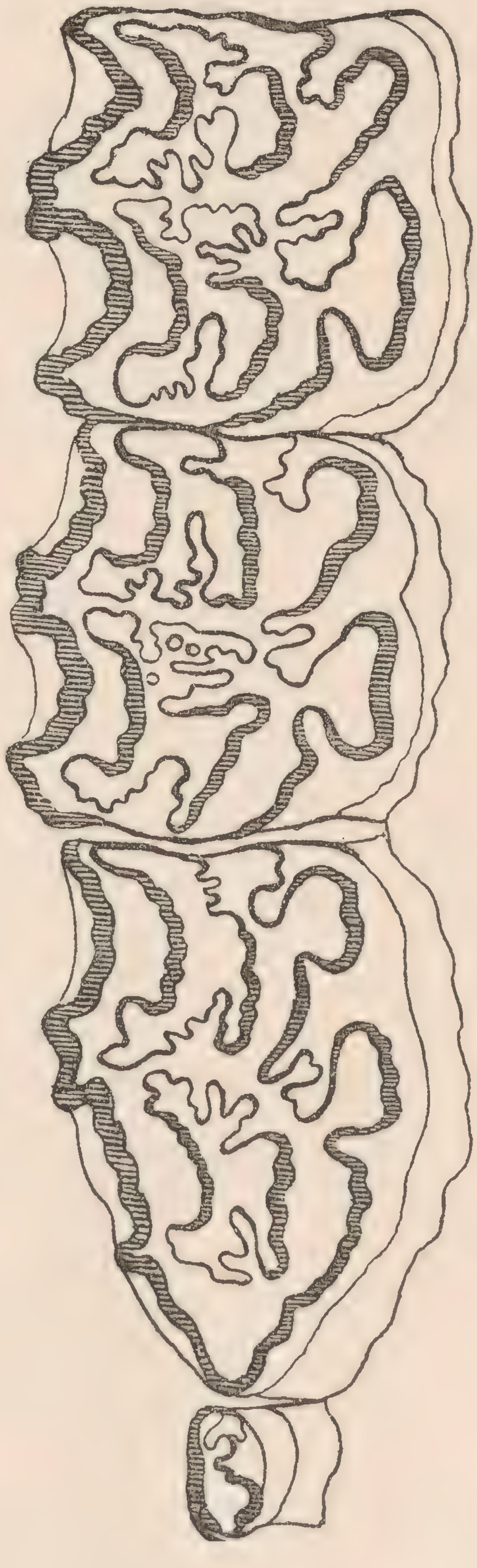

Fig. 24. *Equus pectinatus.* Superior premolars, p^1, p^2, p^3, and p^4. (After Leidy.)

slender than in the larger varieties of *E. caballus*, (6) the lesser curvature of the ribs near their heads indicates that the back was not nearly so wide, but shaped more like that of the ass or zebra. (For description of skull characters see American Museum Bulletin, 1900, Vol. XIII, Art. XIII, pp. 114–116.)

Measurements given.

Diameters of crown of $p^{\underline{3}}$	Antero-posterior	33	mm.
	Transverse	31	"
Diameters of crown of $m^{\underline{1}}$	Antero-posterior	32	"
	Transverse	30	"
Long diameter of incisor		23	"
Total length of molar-premolar series		190	"

The type skull as well as the four other associated skulls in hand when these measurements were given are all of young individuals that had not yet shed all their milk molars. Very fortunately the writer has since collected a skull (No. 10628) from the same deposit or quarry from which the others were taken, in which all the teeth had come into full use (see Pl. XIX, Fig. *A*), and the measurements can now be given more fully and more accurately. They are as follows:

Diameters $p^{\underline{2}}$	Antero-posterior	43	mm.
	Transverse	30.5	"
Diameters $p^{\underline{3}}$	Antero-posterior	34	"
	Transverse	33	"
Diameters $p^{\underline{4}}$	Antero-posterior	33	"
	Transverse	33	"
Diameters $m^{\underline{1}}$	Antero-posterior	30	"
	Transverse	30	"
Diameters $m^{\underline{2}}$	Antero-posterior	31	"
	Transverse	29	"
Diameters $m^{\underline{3}}$	Antero-posterior	31	"
	Transverse	24	"
Long diameter of $i^{\underline{1}}$		24	"
Total length of molar-premolar series		204	"

This species, which is intermediate in size between *E. complicatus* and *E. pacificus*, is distinguished from the former, especially, by its comparatively longer muzzle, which equals in comparative length that of *E. caballus*. From *E. pacificus* it is distinguished by the comparatively smaller skeleton, the somewhat longer muzzle, and by the different form of the occiput; that of *E.*

pacificus being much more like *E. caballus*. *E. complicatus* also resembles *E. caballus* in this respect.

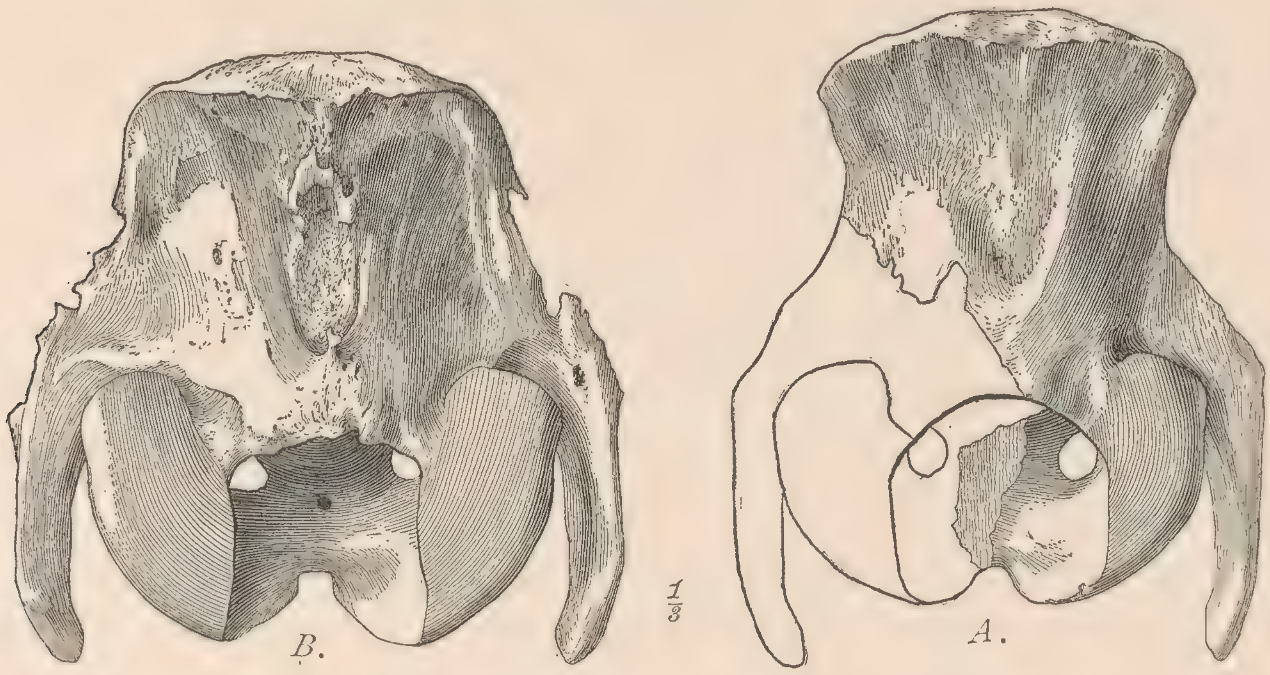

Fig. 26. Occiputs of—*A*, *Equus scotti ; B*, *Equus caballus.*

Equus giganteus, sp. nov.

Type Locality.—Southwest Texas.

Type.—Superior molar (m^2). (No. 8616, Coll. Am. Mus.). This tooth was referred by Professor Cope to *E. crenidens*.

Description.—There is a very large tooth, now in the American Museum (Cope) collection, from southwest Texas which Cope described and figured, referring it to *E. crenidens*, but which differs in every respect, except the small size of the protocone, from the description of the Mexican tooth upon which this species was founded. Its very much larger size; the lack of the charac-

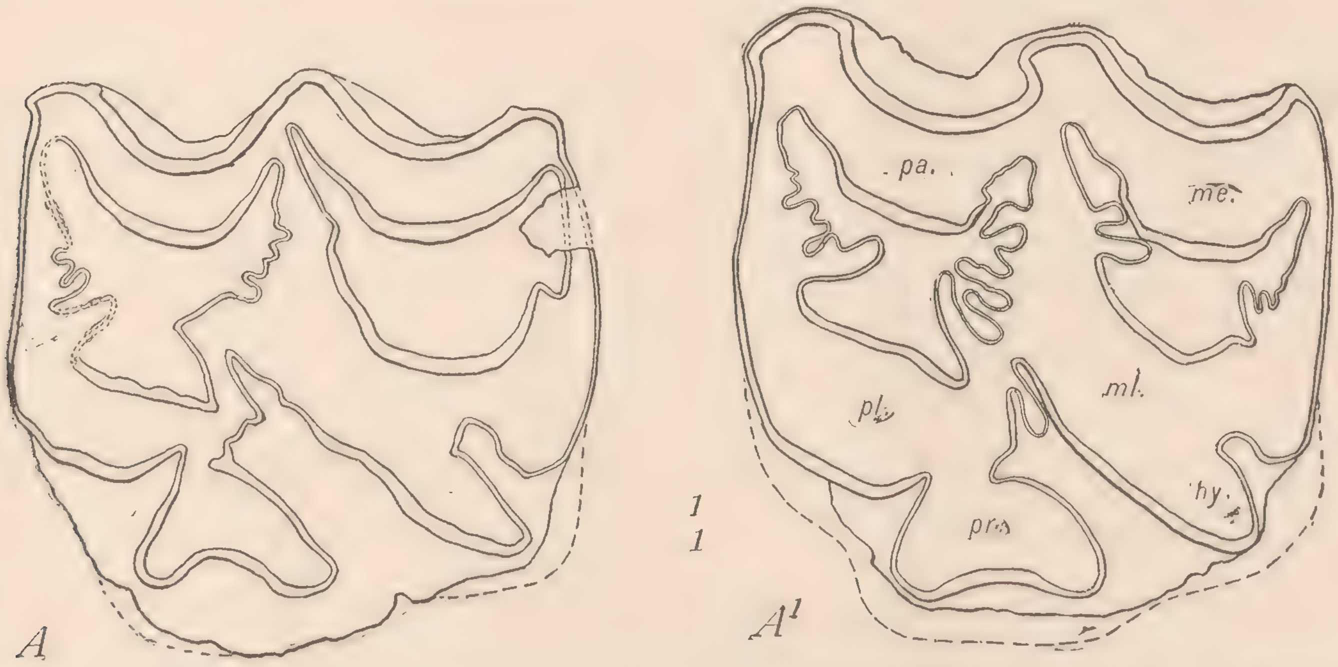

Fig. 27. *Equus giganteus*, sp. nov. Type. Superior second molar m^2 (No. 8616, Coll. A. M. N. H.). *A*, triturating surface ; A^1, section cut about three-fourths of an inch below.

ter given by Cope as the one by which *E. crenidens* could be distinguished, that of the crimping of the enamel of the lakes; the comparatively complex folding of the enamel, all prevent the identification of this tooth with that species. Its grinding-surface is much weathered and the enamel foldings of the lake borders are so obliterated that they cannot be made out and appear to be very simple. This evidently led Cope to the belief, as shown in his figure and description, that the tooth pattern was very simple. A section (Fig. 27 A^1) made about three-fourths of an inch below the grinding-surface shows very plainly the true character of the enamel foldings.

Although in this tooth, as seems characteristic of the genus, there seem to be no characters which can be said to be of definite specific value, its great size, which exceeds by at least 5 mm. any other *Equus* tooth of which record has been made, and the relatively small area of the cement lakes or fossettes mark it as evidently distinct from any species hitherto described; hence a new name seems necessary. The size suggests the name *E. giganteus.*

The measurements are as follows:

Diameter of grinding-surface	Antero-posterior......	41.5 mm.
	Transverse..........	36 "
Diameter where section was made	Antero-posterior..........	40 "
	Transverse................	39 "
Length of crown.................................		100 "

The tooth had evidently been only slightly worn by use, hence the difference in transverse diameter when the cut was made. The length of the tooth compared with its other measurements shows a comparatively short crown.

Summary and Conclusions.

The general results of this systematic comparison may be summed up as follows:

E. curvidens.—A South American horse, indeterminate. North American specimens referred to this species erroneously.

E. major.—Absolutely indeterminate; a *nomen nudum.*

E. americanus.—A preoccupied name, replaced by *E. complicatus.*

E. FRATERNUS.—Southeastern United States, probably a valid species, but still imperfectly known. It represents a very small horse with teeth scarcely as large as those of the Mexican donkey and of very complex pattern.

E. COMPLICATUS.—West Southern and middle Western States; embraces as synonyms, *E. intermedius*, *E eous* and probably *E. excelsus* (which is now indeterminate). Now well characterized, representing a species with teeth about the size of those of the ordinary draught horse and of moderately complex pattern, but with the bones of the skeleton about the size of those of the smaller varieties of the western pony. The species is especially characterized by its short muzzle, in this respect resembling the ass.

E. *excelsus.*—Nebraska. Very imperfectly known from the teeth only ; although now indeterminate, may prove to be a valid species.

E. OCCIDENTALIS.—California or Pacific slope. Other species and specimens have been mistakenly referred to this type. The characters other than those of the teeth are not now known, but these indicate a horse about the size of *E. complicatus* with uniformly simple patterned teeth.

E. PACIFICUS.—A large Oregon species, although middle California is the type locality. A well characterized species. With the exception of *E. giganteus* from southwestern Texas, the largest American horse. The skeleton indicates a horse about the size of the ordinary draught horse, but the skull is proportionately larger.

E. CONVERSIDENS. Valley of Mexico. Apparently well established; of medium size.

E. TAU.—Valley of New Mexico, the smallest true horse known in America. This embraces the *E. barcenæi* as a synonym.

E. crenidens.—Valley of Mexico; indeterminate.

E. SEMIPLICATUS.—Western Texas, from the Sheridan beds of Paloduro Cañon, probably a valid species. The great posterior extension of the vomer over the presphenoid, together with its size and the proportions of the teeth, seem to show a close relationship to *E. asinus.*

E. PECTINATUS.—Port Kennedy Bone Cave of eastern Pennsylvania. Probably a valid species.

E. SCOTTI.—Staked Plains of Texas, Tule Cañon. Intermediate in size between *E. complicatus* and *E. pacificus.* A long-faced type of horse. This species represents a horse about the size of the largest western pony, but with a longer body, a much larger head, a shorter neck, and a back and steeply sloping sides shaped very much as in the ass or quagga.

E. GIGANTEUS.—Southwestern Texas. The largest species of horse hitherto recorded, the teeth exceeding those of the largest modern draught horses by more than one-third the diameter of the latter.

Pliocene species wrongly referred to Equus.

E. simplicidens = Pliohippus sp. ?
E. eurystylus = Hipparion sp. ?
E. cumminsii = Protohippus sp. ?
E. minutus = Protohippus sp. ?
E. phlegon = Protohippus sp. ?

There are a number of teeth in the Niobrara River collection which seem to be intermediate between *E. complicatus* and *E. fraternus*, yet they seem not to show characters sufficiently definite upon which to found a new species. This, however, may be done when better material from the Nebraska locality has been found.

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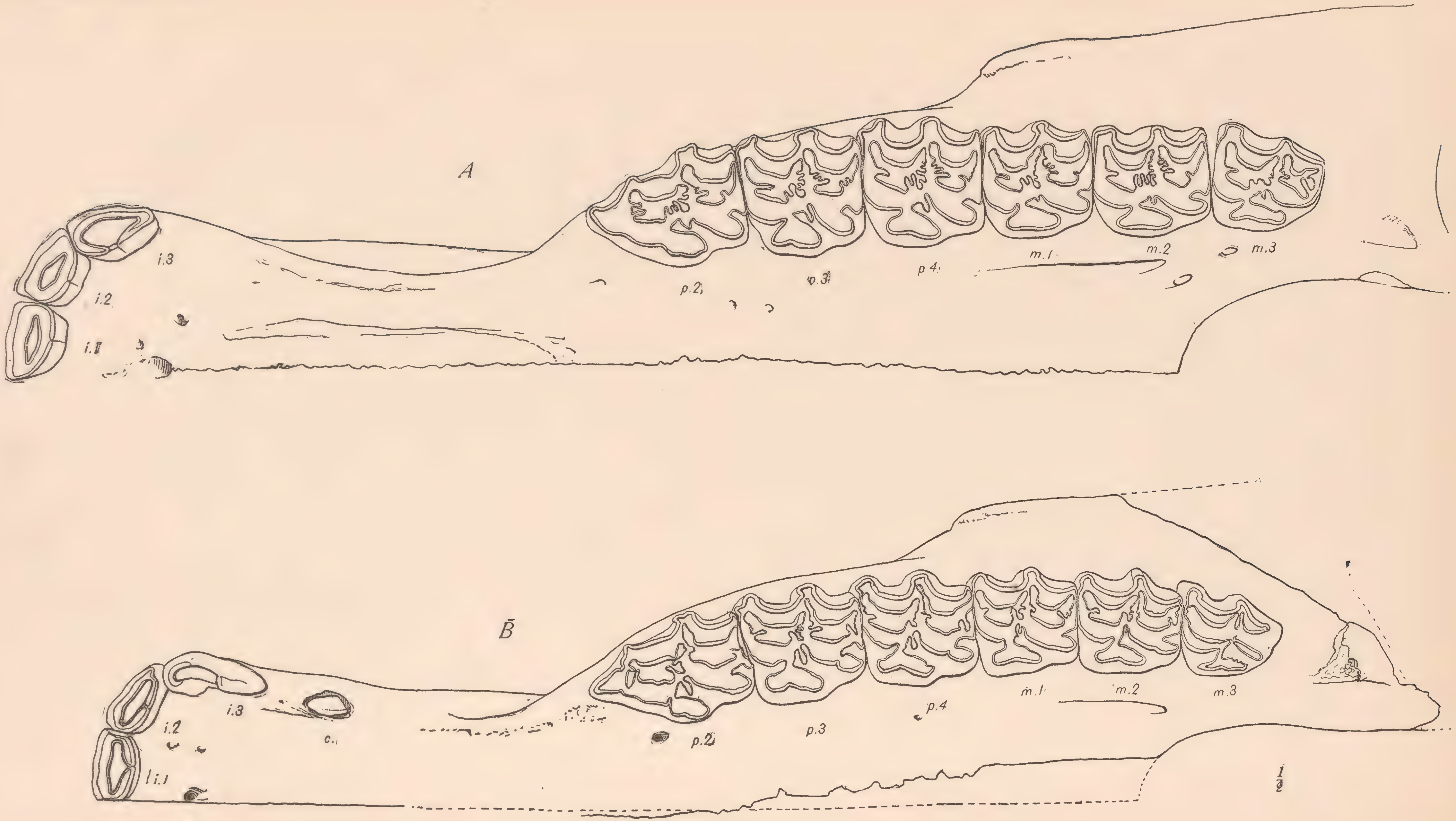
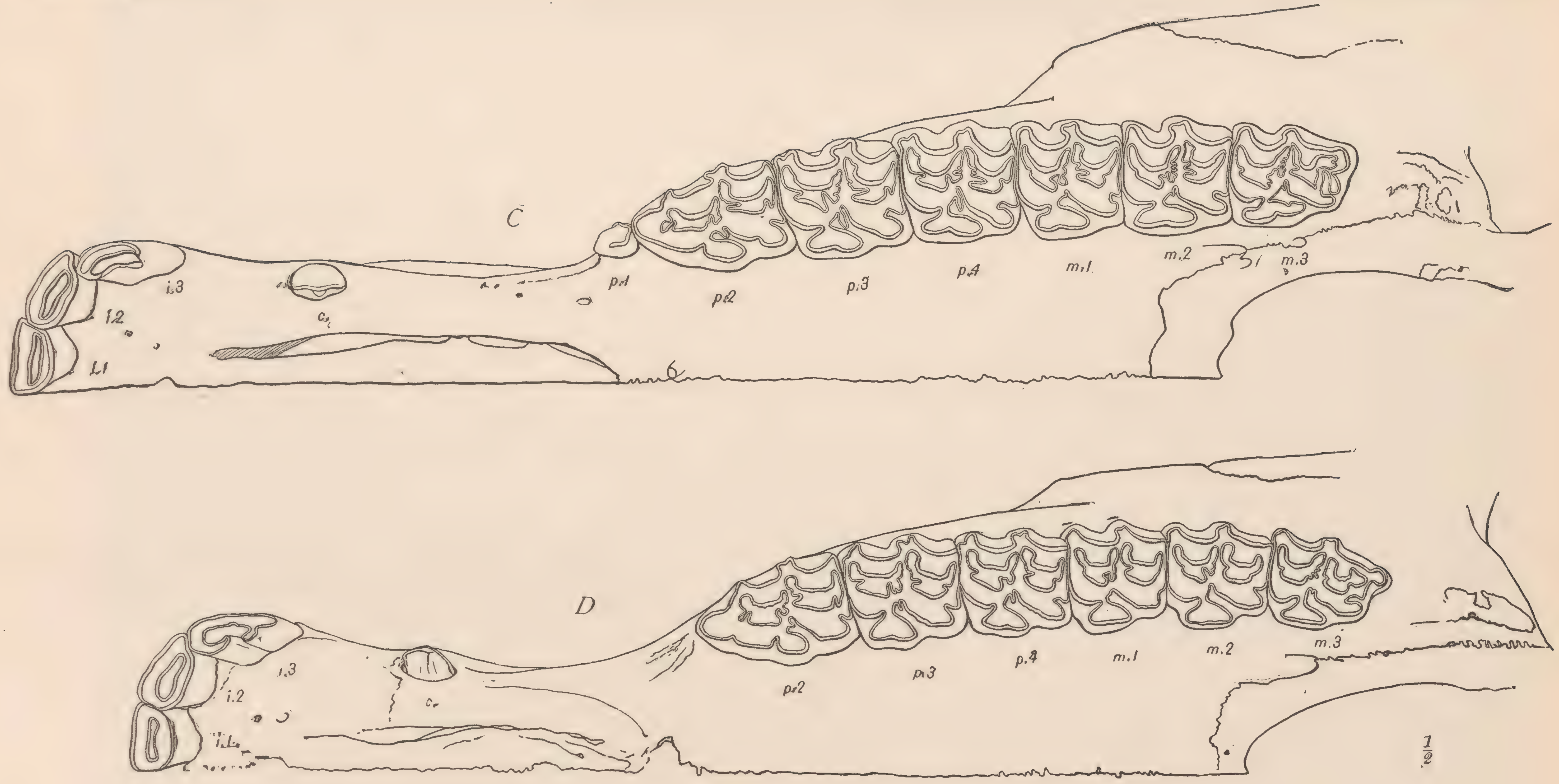
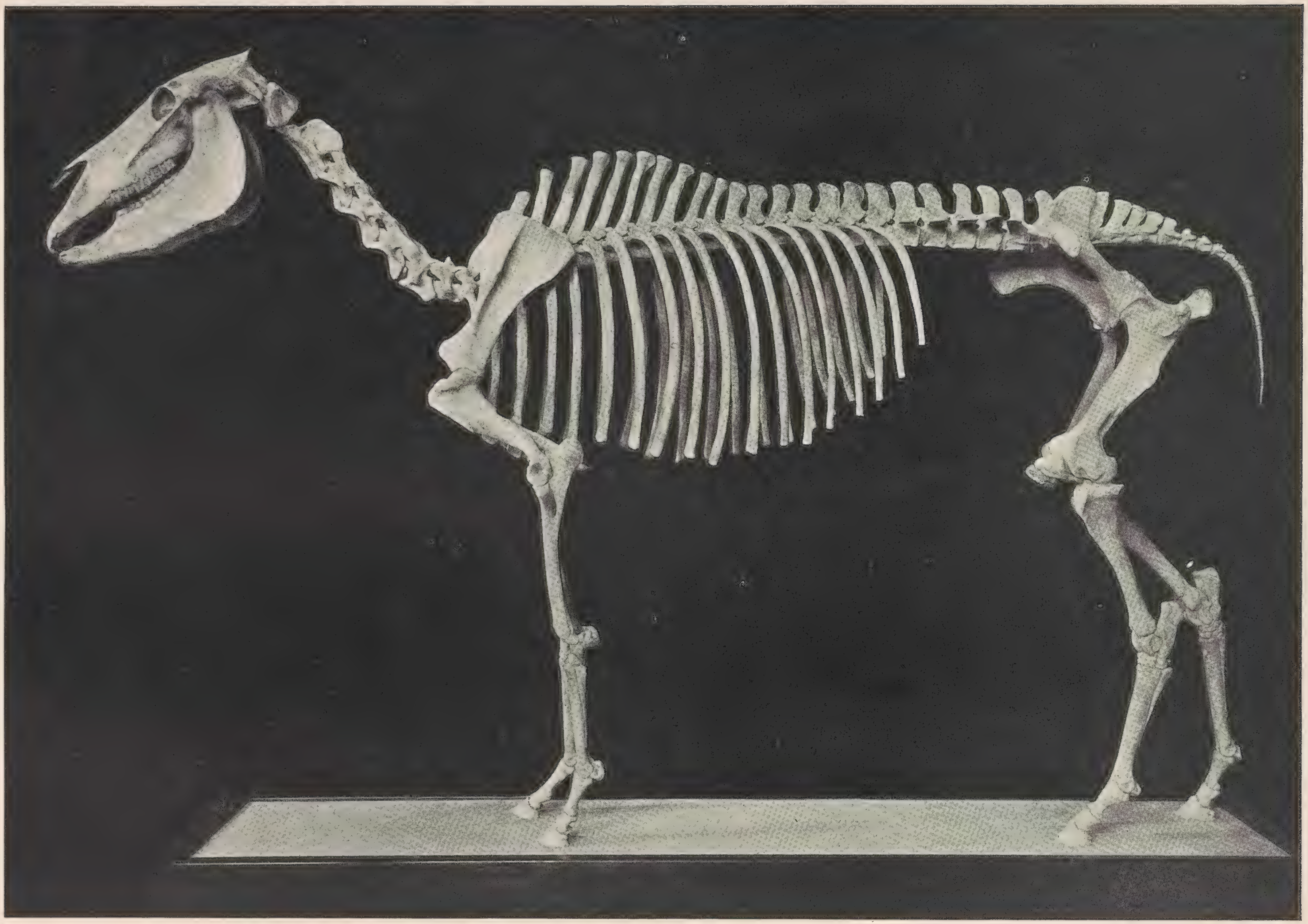


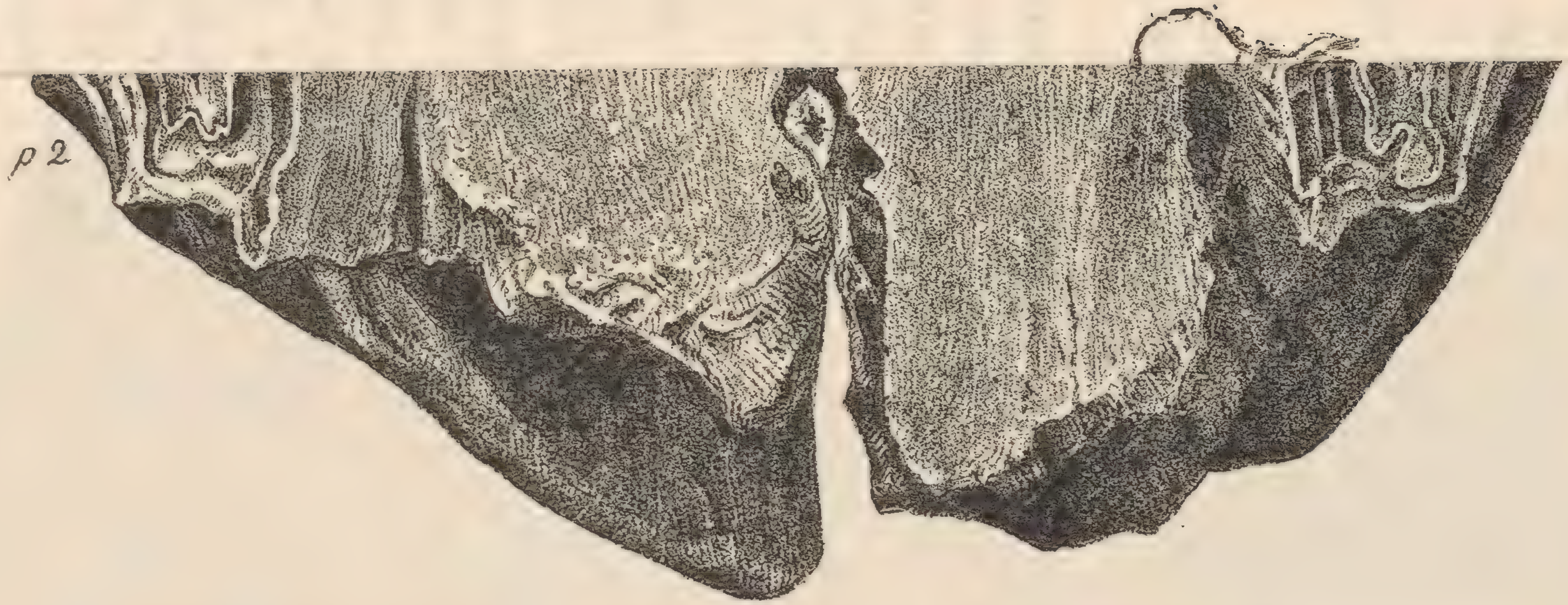
A, *Equus scotti*; B, *Equus complicatus*.



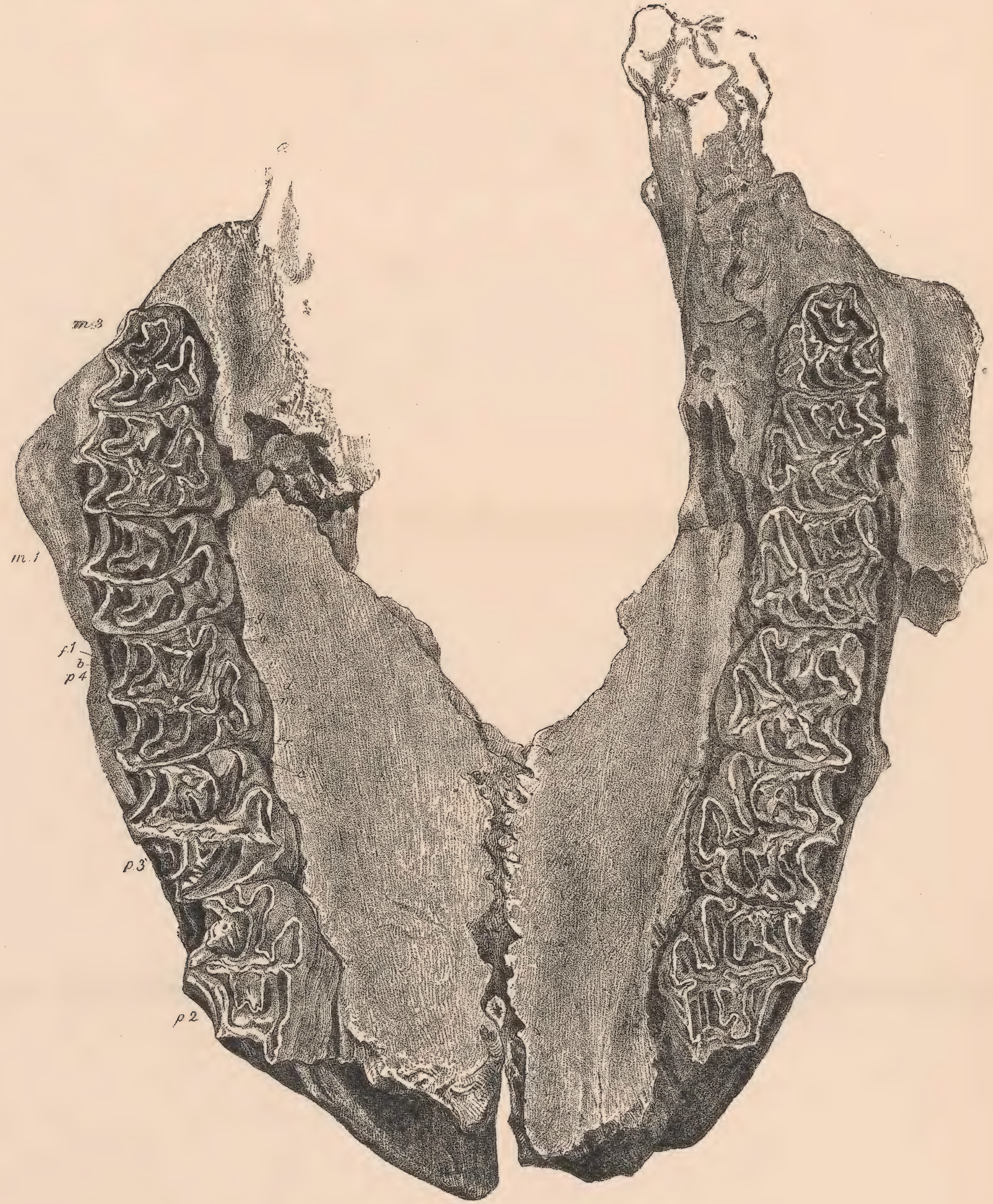
C, *Equus caballus*, Draught Horse; *D*, *Equus caballus*, Texas Pony.



Equus scotti GIDLEY (TYPE). MOUNTED SKELETON IN THE AMERICAN MUSEUM. INCLUDES PARTS OF TWO SKELETONS.



Equus conversidens OWEN (TYPE). PROBABLY COMPOSED OF TWO INDIVIDUALS.



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Article X.—DESCRIPTION OF A NEW CARIBOU FROM KENAI PENINSULA, ALASKA.

BY J. A. ALLEN.

FOUR TEXT FIGURES.

In September and October, 1900, Mr. Andrew J. Stone made an important collection of large mammals for the American Museum of Natural History on the Kenai Peninsula, Alaska, including a good series of Moose (*Alces gigas* Miller), several specimens each of two species of Bears, and the head of the new type of Caribou here described. Unfortunately the entire animal could not be preserved. In recognition of Mr. Stone's important contributions to our knowledge of the distribution of the large game of northern North America, and particularly of Caribou, it may be called

Rangifer stonei, sp. nov.

Type, No. 16701, ♂ ad., head (skin and skull), Kenai Peninsula, Alaska, Sept. 24, 1900; Andrew J. Stone.

Adult Male, in September.—Front of nose back to middle of nostrils, chin, and edges of lower lip grayish or silvery white; top of the nose, from the white muzzle back to a point opposite the eyes, black, passing into dark (blackish) brown posteriorly and on the sides of the head to below the eyes; cheeks and throat still lighter brown; a narrow space surrounding the eye and tear duct grayish; top and sides of neck dark grayish brown, becoming lighter and grayer at the base of the neck, and then abruptly darker in front of shoulders (skin of body not preserved); front of neck white, forming a longitudinal sharply defined band 100 to 130 mm. wide, of greatly lengthened white hair, in strong contrast with the sides of the neck; the white hair attains a length, along the median line, of 200 to 225 mm.

Measurements.—Mr. Stone's measurements of the animal in the flesh are as follows: Total length 85 in. (= 2159 mm.); tail, 6 in. (= 152 mm.); tarsus, 23 in. (= 584 mm.); height to elbow, 28 in. (= 711 mm.); height to brisket, 31 in. (= 712 mm.); height to withers, 52 in. (= 1321 mm.).

Skull.—The skull is narrow and slender in comparison with even that of *R. montanus*, and is further characterized by the slenderness of the antlers, especially the narrowness of the palmated portions, and the unusual development of the brow antler and the anterior branch.

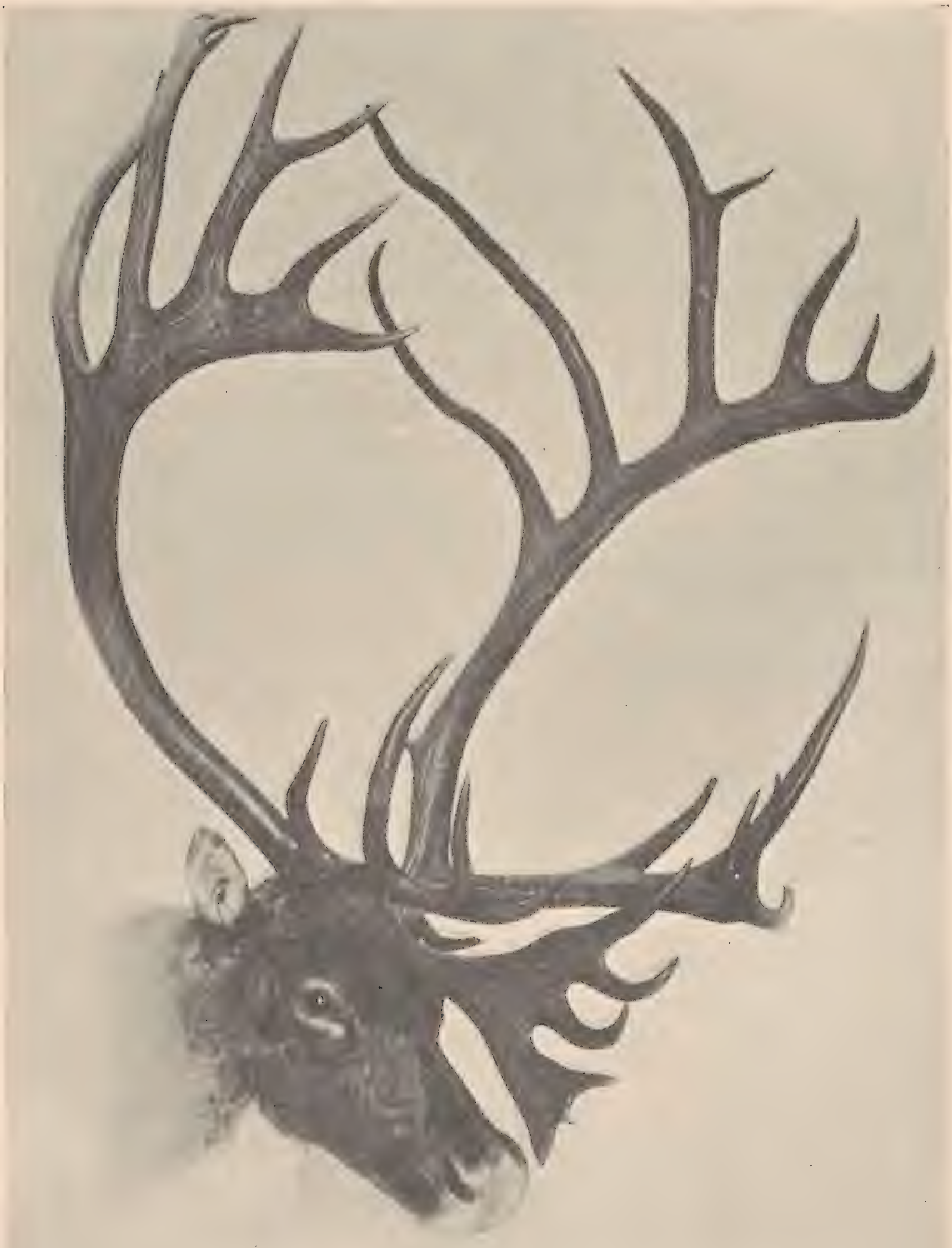

Fig. 1. *Rangifer stonei.* About $\frac{1}{10}$ nat. size.

COMPARATIVE MEASUREMENTS OF SKULL.

	R. stonei. ♂ ad.	R. montanus. ♂ ad.	R. grœnlandicus. ♂ ad.
Basal length	410	420	375
Tip of premaxilla to tip of nasal	125	125	115
" " " " alveolus of p^1	146	148	121
Length of nasals	116	123	111
Breadth above m^2	116	127	115
Zygomatic breadth	153	148	141
Mastoid breadth	158	149	126
Palatal breadth at m^1	67	73	61
Depth of skull between antlers	110	112	94
Upper toothrow, crown surface	95	99	98
Diastema (canine to p^1)	72	72	55
Distance between antlers below the burr	68	78	64
Length of mandible, incisive border to angle	310	330	280
Angle to tip of coronoid	135	148	148
Depth at m_2	37	38	32
Length of lower toothrow	105	103	97
Diastema	124	130	100
Antlers, main beam to tip, along curvature	1170	1235	1000
" greatest spread at point of palmation	800	875	860
" distance between tips of longest tines	900	790	655
" " " points at tip of main beam.	780	555	575

Rangifer stonei is a striking member of the Caribou group, resembling *R. montanus* in its dark coloration, but differing in the great development of the heavy fringe of white hairs on the front of the neck, and its striking contrast in color with the adjoining portions of the neck. Should this prove constant it will form an easily distinguishing mark. The antlers, fully illustrated in the accompanying figures (Figs. 1–4), from photographs,[1] recall in some respects those of the Barren Ground forms of Caribou (including *R. grœnlandicus*), but they are much heavier, with better developed and more numerous tines, a special feature of differentiation being the large size and peculiar form of the anterior branch. The skull is long and slender, the facial portion especially narrow, the occipital broad, the nasals short, and the lower jaw slender.

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[1] The photographs are made to the same scale as those illustrating my paper on the Mountain Caribou (this Bulletin, XIII, pp. 1–18), and I am indebted for them, as before, to the skill of Mr. J. Rowley.

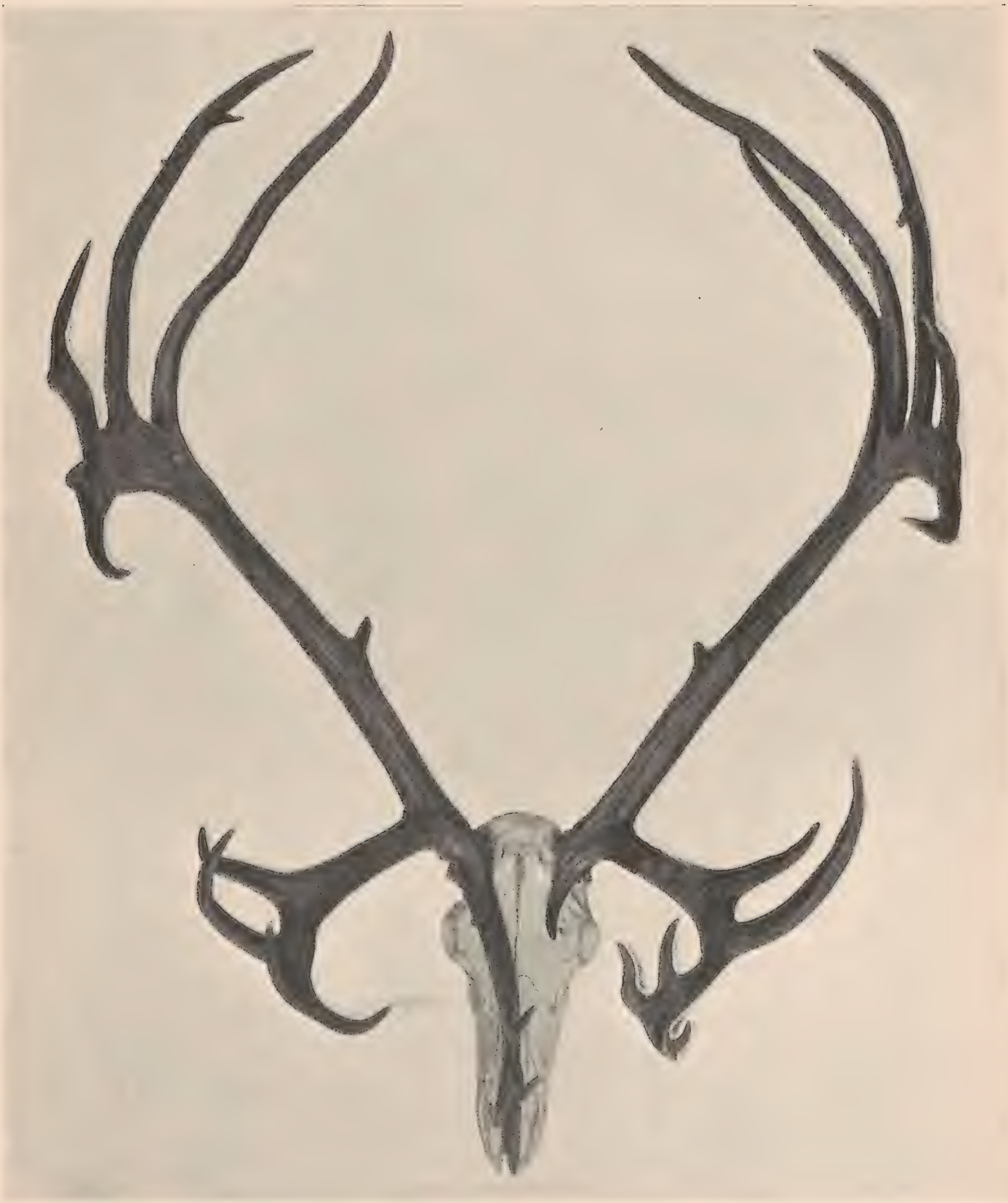

Fig. 2. *Rangifer stonei.* About $\frac{1}{10}$ nat. size.

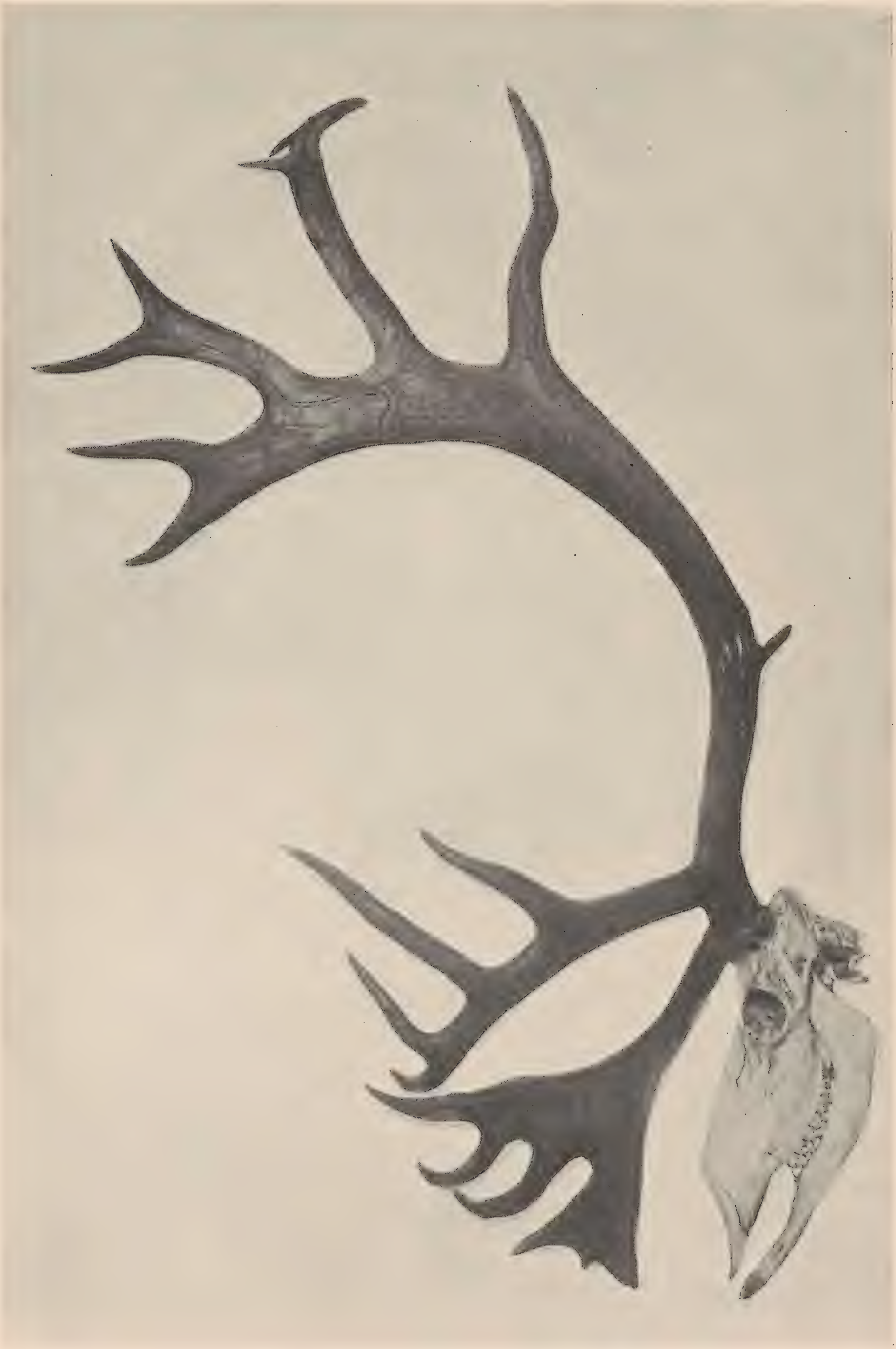

Fig. 3. *Rangifer stonei*. About $\frac{1}{10}$ nat. size.

According to Mr. Stone the specimen here described is an average adult male, the hunters claiming that they often get much finer heads. Caribou, he says, are already very scarce on the Kenai Peninsula, and will doubtless soon be exterminated, the region being greatly frequented by visiting sportsmen, while native hunters kill the Moose and Caribou for their heads, disposing of them at good prices for shipment to San Francisco.

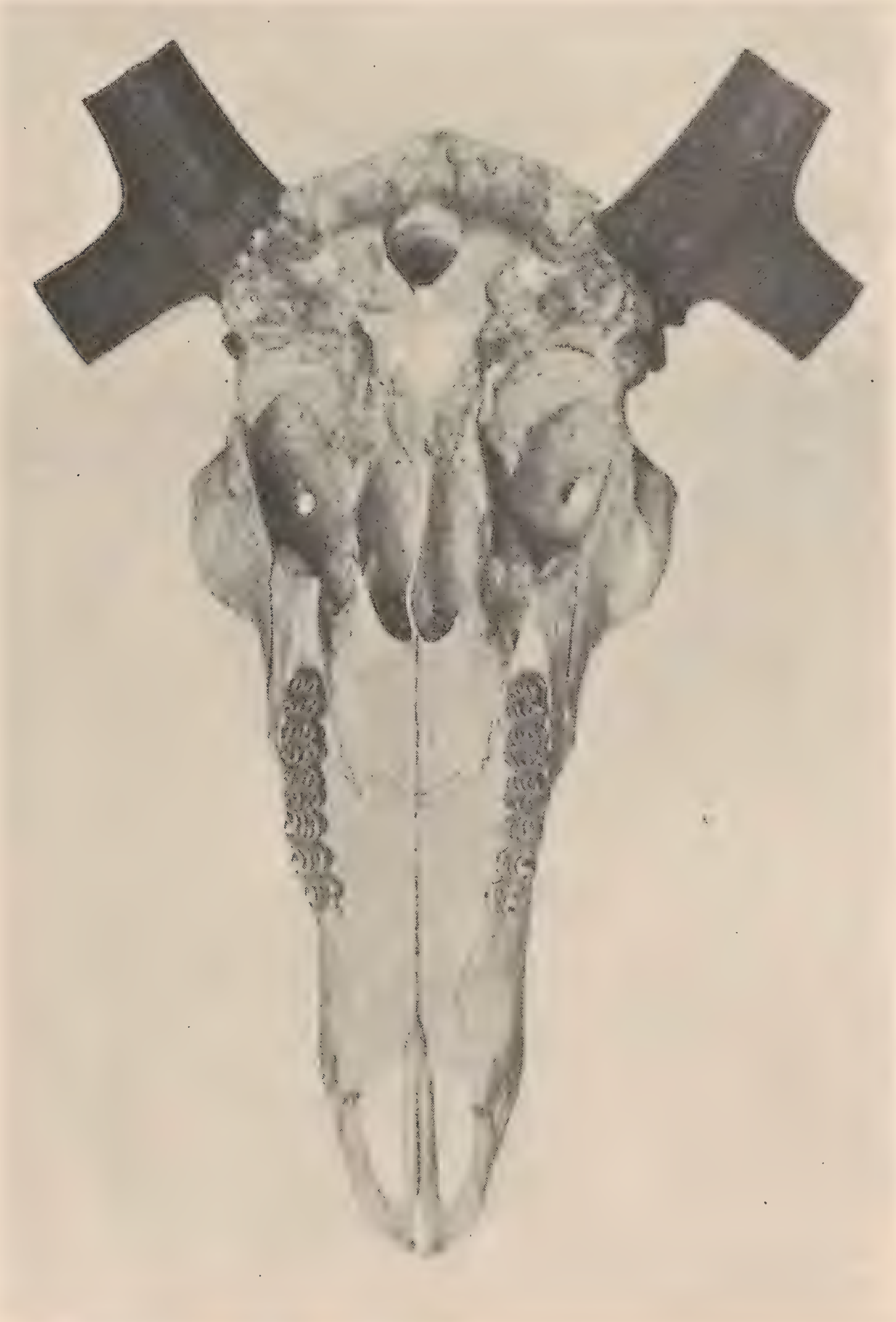

Fig. 4. *Rangifer stonei.* About $\frac{1}{5}$ nat. size.

Article XI.—A PRELIMINARY STUDY OF THE NORTH AMERICAN OPOSSUMS OF THE GENUS DIDELPHIS.

By J. A. Allen.

Plates XXII–XXV.

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INTRODUCTION.

The present paper relates primarily to the forms of the genus *Didelphis* occurring in Mexico and the United States, to which area my material is mainly limited. It embraces, however, a few specimens from Guatemala, Nicaragua, and Costa Rica, and many examples from the Cauca region of western Colombia, the Santa Marta region of eastern Colombia, and the island of Trinidad. For nearly all of the Mexican material, which forms the principal part of the collection, and much of that from the United States, I am indebted to the kindness of Dr. C. Hart Merriam, Chief of the Biological Survey of the United States Department of Agriculture, without the generous offer of which this paper would not have been undertaken. The Mexican specimens were nearly all taken by Messrs. E. W. Nelson and E. A. Goldman, so well known for their explorations in Mexico and Guatemala. I am also indebted to Mr. G. S. Miller, Jr., and the authorities of the National Museum for access to series of specimens from Yucatan, Guatemala, and Costa Rica.

The specimens examined number about 350 skins and nearly 100 additional skulls, of which 115 skins and 40 additional skulls are from the United States, 187 skins and 34 skulls from Mexico and Guatemala, 10 from Costa Rica, 26 from Colombia, 3 from Venezuela, and 12 from Trinidad. While this material far exceeds that previously available for the study of the group, it is very inadequate for more than a preliminary survey of the field. Besides the lack of material, the study of the group is rendered exceptionally difficult in consequence of the wide range of individual variation these Opossums present, and also by the peculiar character of the pelage, and the lack of any well defined pattern of coloration.

Beginning with the Opossums of the United States and proceeding thence southward to northern South America, several well marked features of variation are prominent. While at the North the animal is at about its average size, judged especially by the skull, there is found in proceeding from the North southward a very marked increase in the length of the tail, which in the northeastern States is less than 70% of the length of the head and body, while in tropical latitudes its length often equals the length of the head and body, sometimes exceeds it, and generally falls but little short of it. The ears are small in the northern animal in comparison with its southern representatives, in tropical examples the ear having far greater superficial area than in extreme northern specimens.

The coloration also varies markedly, not only as regards the pelage but in respect to the ears and tail. In the United States (the *D. virginiana* group) the dark basal portion of the tail generally extends little if any beyond the portion covered by the long hair at its base. In the Mexican and South American forms the dark color usually occupies the basal third, often one half, and sometimes two thirds of its length. In the northern animal the ears are black, tipped more or less broadly with flesh color, the amount decreasing southward, even to some extent within the United States; while in tropical latitudes the ears are wholly black in all the forms of the *Didelphis* group, except in *D. aurita* of southeastern Brazil, in which they are again tipped with flesh color, and in *D. pernigra* of Peru, in which they are wholly white.

The color of the feet also varies geographically, at the north the toes on all the feet being usually white apically, but the white extends further up the toes on the fore feet than on the hind feet.

Northern specimens have the nails and outer joints of the toes on the hind feet usually white, but the amount of white varies, being often restricted to one or the other of the hind feet, while the opposite one is entirely black, or, in Florida and the Gulf States, both hind feet may be black. The fore feet are always more or less white in northern specimens; in New York and New Jersey examples the toes are often white for their whole length, while at more southern localities, as in Florida and along the Gulf Coast, only the nails and terminal phalanges are white. In Mexican and South American specimens the toes on both fore and hind feet are wholly black.

Geographical variation in the character of the pelage is strongly marked. The northern animals (*D. virginiana* and *D. v. pigra*) have a long, soft, thick coat of woolly underfur, which is whitish basally for about four fifths of its length, only the longer fibres being tipped with black. Over this underfur is a thin covering of long, coarse, more or less bristly white hairs, usually sufficiently abundant to give a whitish coloration to the animal, through which the black apical zone of the underfur is more or less visible, producing a general grizzled effect. The whole head is white except a blackish eye-ring and a very small dusky spot in front of the eye, and a dusky area on the top of the head, terminating about midway between the eyes and the ears. In the tropical forms the pelage is much coarser, the coat of underfur less soft and full, and the black tipping involves about one third of the length of the underfur, which forms a conspicuous element in the superficial coloration. The long bristly white hairs, so abundant in the northern animal, are often replaced in the southern forms by bristly black hairs, the animal then being essentially black, a black phase and a gray phase often occurring at the same localities. In other words, the Opossums at many points south of the United States are dichromatic.

In southern specimens (*D. marsupialis* and *D. karkinophaga*, with their respective subspecies) the pure white cheeks alone represent the almost entirely white head of the *D. virginiana* group of the North. The white color of the cheeks is sharply cut off above by a dark band running from the base of the ear through the eye to the nose; the dark color of the top of the head forms a rather prominent median stripe, while the rest of the upper surface of the head is tinged more or less strongly with dusky. There is usually a more or less well defined white area at the inner base of the ears, this with the white cheeks constituting the only white areas on the head. Often, however, the ear patches are obscured by a dusky wash.

A study of the skulls reveals an amazing amount of variation, dependent partly upon age and sex, but in large measure due to individual variation; there is, however, a considerable amount of geographical differentiation, most strongly shown in the form of the nasal bones. The variation in the form and size of the skull as modified by age is so considerable that it has been deemed worth while to illustrate this feature, as well as to give a few illustrations of individual variation, and of certain abnormalities of dentition. The halftone figures here given (Plates XXII–XXIV) are, with two exceptions (later duly indicated), one half natural size, and are from excellent photographs kindly taken for me by Mr. Frank M. Chapman, Associate Curator of the Department of Mammalogy and Ornithology.

The extensive array of measurements given in Tables I–VI at the end of this paper include about 15 measurements each of some 200 skulls of the genus *Didelphis*, and 4 external measurements of about the same number of specimens, taken in the flesh by the collector. These measurements, with the accompanying ratios, so well illustrate variations due to age, sex, and locality, as well as affording means for comparison of five species and as many additional subspecies, that they seem entitled to permanent record.

While the amount of material at present available is too limited, as already said, for even a very satisfactory reconnoissance of the group as regards its geographic forms, its careful study has yielded some results of considerable interest relating especially to the skull, dentition, and external characters.

SKULL AND DENTITION.

The skull in the Opossums of the genus *Didelphis* is remarkable for the great development of the sagittal and occipital crests, which become very highly developed in old age in both sexes. The deposition of bony matter appears to continue throughout the life of the animal, the skull increasing in its principal dimensions as long as the animal lives. At the time of the appearance of the first upper true molar(m^{1}) the skull (then about 45 mm. long) is entirely smooth, without trace even of postorbital processes; by the time the third upper molar (length of skull now about 80 to 90 mm.) has come into use, the sagittal and occipital crests appear as low ridges about a millimetre in height. By the time the last upper molar has become functional the sagittal crest has attained a height of 4 or 5 mm. and the occipital ridges are proportionately developed. In middle-aged specimens the sagittal crest has usually attained a height of about 8 to 10 mm., which increases in old age to 12 to 14 mm., and the occipital ridges form a broad posteriorly projecting crest. (See Plate XXII.)

Sexual Variation in the Skull.

In the female the skull is of slighter build than in the male and averages about 10 per cent. smaller in external dimensions. It is narrower and slenderer, the zygomatic breadth decidedly less, the muzzle narrower, and the canines less strongly developed; nevertheless the sex cannot be distinguished with certainty from an examination of the skull, owing to exceptional variations in both males and females. Occasionally a female skull has the large size and heavy development ordinarily seen in the male, while, on the other hand, small male skulls are so slender and delicate as to exactly resemble the skull of the average female. In the general character of the dentition, aside from the usually weaker canines of the female, there is little difference in the sexes, and there is little or no difference in the relative development of the sagittal and occipital crests. While it thus happens that female skulls are sometimes larger than some male skulls strictly comparable with them as to age, it may be said that nearly all male skulls of the *D. virginiana*, *D. marsupialis*, and *D. karkinophaga* groups exceed 110 mm. in basal length, and that nearly all female skulls fall below this measurement. As indicating the relative size of males and females, and the geographical distribution of the larger skulls in the present series, the following tables may be of interest.

The 21 largest male skulls out of a series of about 200 are here listed, the two measurements given being the total length and the zygomatic breadth, with the ratio of breadth to length.

Total length. mm.	Zygomatic breadth. mm.	Ratio.	Locality.
139	68	49.2	Tumbala, Chiapas, Mexico.
136	69	50.7	Jico, Vera Cruz, "
134.5	68	50.5	Huehuetan, Chiapas, "
131	69	52.6	Hatteras, North Carolina.
131	69	52.6	Bay St. Louis, Miss.
131	65	49.6	Virginia Point, Texas.
131	67	51	Tehuantepec, Oaxaca, Mexico.
130	70	53.3	New Jersey.
130	67	51.5	Frontera, Tabasco, Mexico.
129	66	51	San Antonio, Texas.
128	72	56.2	Miller's Place, Long Island, N. Y.
128	68.3	53.3	Port Lavaca, Texas.
128	72	56.2	Vernon, Texas.
127	67.5	53	Armeria, Colima, Mexico.
125	63	50.4	Manzanillo, " "
124	66	53.2	Iowa Station, La.
124	60	48.3	Metlaltoyuca, Puebla, Mexico.
124	70	56.4	Hatteras, North Carolina.
123	64	52	Tuxtepec, Oaxaca, Mexico.
122.5	69	56.3	Danville, Tenn.
122	63	51.6	Lake Harney, Fla.

The 12 largest female skulls from the same series are the following:

Total length. mm.	Zygomatic breadth. mm.	Ratio.	Locality.
120	58	48.3	Tuxtepec, Oaxaca, Mexico.
119	61.6	51.7	San Antonio, Texas.
118.5	55	46.4	" " "
118	62	52.5	Garrettsville, Ohio.
118	57	48.3	Golden City, Mo.
117	57	48.7	Riceboro, Georgia.
117	59.3	50.7	Manzanillo, Colima, Mexico.
116	60.5	52	Matagorda, Texas.
116	58	50	Velasco, "
114	55	48.2	Greytown, Nicaragua.
114	62.5	55	Montauk Point, Long Island, N. Y.
114	56	49	Tumbala, Chiapas, Mexico.

A comparison of these two lists, which consist in both cases of skulls much above average size, shows that the largest female skull is decidedly smaller than the smallest male skull; in males the range in total length being from 122 to 139 mm., and in zygomatic breadth from 63 to 69 mm.; the corresponding ranges for the females being, respectively, 114 to 120 mm., and 55 to 62.5 mm. The ratio of the two measurements ranges from 48.3 to 56.4 in the males, and from 46.4 to 55 in the females.

From the preceding tables it will be seen that the largest skulls are dispersed over a wide geographic area, and that most of the extremely large skulls are from Mexico. This is due in part doubtless to the fact that in the unsettled portions of that region they are subjected to less persecution from man and thus more frequently live to very old age, than in the more settled regions of the United States. At all events, skulls bearing the marks of extreme senility are more frequent in the Mexican material than in that from the United States; yet certain skulls from North Carolina, Mississippi, and southern Texas stand well toward the head of the list, as regards both size and age.

Taking the whole series of skulls into consideration, it is found that some obviously *very old* male skulls measure down to 112 x 58.5 mm. (Armeria, Colima), and even as low as 107.5 x 52 mm. (San Juan Capistrano, Zacatecas), while some 'young adult' males fall as low as 95 x 46 mm. (Brownsville, Texas). Very old female skulls sometimes measure as low as 103 x 47 mm. (Teapa, Tabasco), and 'young adult' female skulls as low as 90 x 44 mm. (Mazatlan, Guadalajara, and Papantla.) The extreme range in very old males is therefore from 112 to 139 mm. in total length, and from 58 to 69 mm. in zygomatic breadth; and in very old females from 90 to 120 mm. in length and 40 to 62 mm. in zygomatic breadth. This indicates the amount of normal individual variation in cranial measurements that may be expected in any large series of skulls, even, it may be added, from practically the same locality.

Variation due to Age, etc.

There is not only a wide range of sexual, individual, and age variation in size and proportions in the skull considered as a whole, but, as would be naturally expected, also in its various parts, as in the form and relative stoutness of the zygomatic arches, the length and form of the palate, the nasals, etc., and in the size of the teeth. Without going into details, except in respect to the nasals, to be considered presently, it may be said that the palate varies greatly in respect to the ratio of its breadth to its length, and in the relative development and form of its posterior border, the latter varying, especially with age, from a deeply concave to a straight outline; in old age it becomes built out posteriorly by bony deposition, and at the same time tends to become narrower. This change is parallel to the increasing narrowness of the skull, with advance in age, at the postorbital constriction, this region being broader in young adults than in middle-aged specimens, and still narrower in very old examples; for while the skull continues to increase in extreme dimension from middle life onward to old age, the postorbital region becomes more and more constricted, as is the case generally in animals in which the skull is normally greatly constricted postorbitally.

The toothrow tends to become shorter, through normal processes of absorption, with great increase of age. There is, however, a rather wide range of variation in respect not only to its length, but in the size of the individual teeth in specimens from the same locality, strictly comparable as to sex and age, as shown later in the detailed tables of measurements. While in female skulls the teeth are generally smaller and more delicate than in the males, there are many exceptions to the rule, due to cases of marked individual variation in both sexes.

The lower jaw is as markedly subject to variation due to growth and age as is the skull in respect to size and the development of the sagittal and occipital crests. This is especially apparent in the angle formed by the coronoid process with the main axis of the jaw. During the evolution of the teeth the last molar appears, as usual, on the inner side of the anterior base of the coronoid, so that when the last lower molar has just come into use its posterior border is close to the anterior base of the coronoid. As the growth of the jaw continues after all of the teeth are in place, a space begins immediately to appear between the last molar and the anterior border of the base of the coronoid, which continues to increase with age as long, apparently, as the animal lives, so that in old age the last molar may be 6 to 10 mm. from the front border of the coronoid. With the increase in the length of the jaw, after practical maturity, and the coincident development of the space on the alveolar border between the last molar and the front edge of the coronoid, a change occurs in the angle made by the coronoid with the horizontal portion of the ramus, the angle formed by the two axes becoming gradually more open or wider, due to the increased backward slope of the coronoid. This is a fact worthy of attention in comparing young adults with middle-aged or very old specimens. There is also often great individual variation in the slope of the coronoid in specimens of comparable age from the same locality.

Nasals.

Normally the nasals are narrow apically for a little more than half their length; then they abruptly expand, the expanded portion taking the form of a rhomboid, being diamond-shaped in outline; the expanded portion occupies a little less than one half the total length (about 42 to 48%). The transverse axis of this expanded portion varies from 75 to 100% of its longitudinal in different specimens from the same locality. The posterior half of the expanded portion may be pointed and symmetrical in outline, but usually it is shorter than the anterior half, and not infrequently the posterior border is abruptly truncated. The narrow anterior portion is of nearly equal width throughout, but the breadth varies in individuals from the same locality, the variation amounting to about 30% of the mean. (See Pl. XXIII, Figs. 1 and 2.)

The ratio of the nasals to the basal length of the skull varies in comparable specimens from the same locality from 46 to 58%. The ratio does not appear to be affected by age. The breadth varies proportionately more than the length, the breadth being correlated with the breadth of the rostral portion of the skull. Examples of narrow-nosed skulls and broad-nosed skulls from the same locality and of the same sex occur too frequently to render the difference of any importance as a trustworthy character in comparing small series of skulls from different localities. In two skulls from a single locality in Texas the nasals have a length respectively of 48.8 mm. and 52.9 mm., with a corresponding difference in the length of the rostrum, both specimens being middle-aged males. Yet, as will be shown later, the form of the nasals is sufficiently constant to afford a character of much importance in the discrimination of subspecies.

Supernumerary Teeth, and other Cranial Abnormalities.

In the present collection several cases of supernumerary teeth have been noticed, involving the true molars, premolars, and canines.

Molars.—Specimen No. 73492, adult male, Tehuantepec, has a supernumerary (fifth) true molar behind $m^{\underline{4}}$ on both sides (see Pl. XXIII, Fig. 5); it is about half the normal height, and is patterned on the plan of $m^{\underline{4}}$, from which it differs mainly in its smaller size. In No. 77688, adult male, Huehuetan, Chiapas, there is a well developed fifth molar in the left side, similar in character to $m^{\underline{4}}$, but about one third smaller (Pl. XXIII, Fig. 6).

In No. 14614, adult female, Santa Marta, Colombia, $m^{\underline{4}}$ on both sides is V-shaped, having two equal outer angles, and thus is practically of the same pattern as $m^{\underline{3}}$, except that it is shorter, and the middle cone of the outer border is suppressed.

No. 33831, young adult male, has on the right side a minute tooth about the size and shape of a small incisor, situated between $m^{\underline{1}}$ and $m^{\underline{2}}$, in the outer border of the toothrow.

In several specimens teeth abnormal in position have been noticed, especially in the case of $m^{\underline{4}}$, which may be thrown inward, or backward, in the latter case leaving a space nearly the width of the tooth between it and $m^{\underline{3}}$. In general the outer edge of $m^{\underline{4}}$ forms the most projecting portion of the toothrow, being even with or projecting slightly beyond the outer border of $m^{\underline{3}}$. In quite a number of cases $m^{\underline{4}}$ is placed inward, so that the outer edge of $m^{\underline{3}}$ projects considerably beyond $m^{\underline{4}}$.

Premolars.—Several instances have been noted of the occurrence of a minute supernumerary premolar, on one or both sides of the skull. Thus, in the skull last mentioned (No. 33831), there is a minute tooth on the left side between $p^{\underline{4}}$ and $m^{\underline{1}}$, and another between $m^{\underline{1}}$ and $m^{\underline{2}}$. No. 100507, young adult male, and No. 100508, young adult female, both from Frontera, Tabasco, each has a minute supernumerary tooth on the outer alveolar border between $p^{\underline{3}}$ and $p^{\underline{4}}$ on each side. There is also a similar development in No. 56857, adult male, and No. 58688, adult female both from Mirador, Vera Cruz. An old female from Rockport Texas, has a minute supernumerary tooth between $p^{\underline{3}}$ and $p^{\underline{4}}$ on each side, on the outer alveolar border.

Canines.— No. 45401, adult male, Bay St. Louis, Miss., presents a case of the nearly equal development of two canines on the left side (see Pl. XXII, Figs. 5 and 5a), not only similar in size, but also in form, standing close together, one behind the other. The two teeth have, at the alveolar border, nearly twice the longitudinal diameter of a normal canine.

CHANGE IN COLOR OF THE EARS WITH AGE.

Perhaps the most interesting feature of color variation is the change in the ears from flesh-color in the nursing young to black in the adult. Very young animals, from whatever locality, have the ears at first entirely flesh-color or yellowish white. In the North this is gradually replaced by black until the whole ear becomes black, except the apical border, which varies from a mere edging to an area half an inch in extent; while further southward, from the Rio Grande region throughout Mexico and to northern South America, the ears in the adult are entirely black. The change from the flesh-colored ear of the young to the black of the adult is gradual, the black generally beginning at the base and extending upward, as illustrated by a number of young specimens that have passed beyond the first stage.

In this connection I may be allowed to correct an error based on an examination of young specimens from Costa Rica which, having particolored ears, I identified some years ago[1] as *Didelphis aurita.* In the light of the present material, these specimens prove to be merely in the intermediate stage of color change in the ears, and have no relation to the true *D. aurita* of southern Brazil, which in the adult has the apical portion of the ears flesh-color, as in the Virginia Opossum of the North.

NOMENCLATURE.

The genus *Didelphis* of Linnæus is retained for the present group (*cf.* this Bulletin, XIII, 1900, pp. 185–190), the type being, by elimination, *D. marsupialis* Linn. The specific name *marsupialis* is restricted to the Mexican species, for reasons given beyond (pp. 163, 164); *D. karkinophaga* is retained for the forms occurring in northeastern South America, and *D. virginiana* for those of the United States.

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[1] This Bulletin, III, No. 2, 1891, p. 217.

SYNOPSIS OF SPECIES AND SUBSPECIES.[1]

A. Posterior border of nasals forming a V-shaped point.
- *a*. Tail black only at extreme base; generally less than two thirds the length of head and body (tail ratio about 70)........*D. virginiana.*
- *b*. Tail black for basal third; generally four fifths the length of head and body, or more (tail ratio about 90–95).......*D. marsupialis texensis.*
- *c*. Tail black for basal one third to one half; generally as long as head and body or longer (tail ratio about 100–110)..............*D. richmondi.*

B. Posterior border of nasals obtusely truncated. Tail black for basal one third to one half, or more.
- *a*. Nasals very short and very obtuse posteriorly; tail generally about nine tenths the length of the head and body (tail ratio about 85–95) *D. marsupialis.*
- *b*. Nasals much longer and less obtusely pointed posteriorly (tail ratio 95 105)..................................*D. marsupialis tabascensis.*

Didelphis virginiana *Kerr.*

VIRGINIA OPOSSUM.

Didelphis marsupialis LINN. Syst. Nat. ed. 10, 1758, 54. (In part only.)

Virginian Opossum, PENNANT, Hist. Quad. 1781, 301, no. 181, pl. xxxiv. (Excluding Mexican and South American references.)

Didelphis virginiana KERR, An. King. 1792, no. 386, p. 193. (Based on Pennant, as above.)

Didelphis virginiana SHAW, Gen. Zoöl. I, pt. 2, 1800, 473. (Based exclusively on the Virginia Opossum.) Also of most recent authors.

Didelphis woapink BARTON, Facts, Observations, and Conjectures relative to the Generation of the Opossum of North America, 1806, 2.

"*Didelphis pilosissima* and *illinensium* LINK," apud Gray, List Mamm. Br. Mus. 1843, 100. (*Cf.* Thomas, Cat. Marsup. and Monotr. Br. Mus. 1888, 325, footnote.)

Type locality.—Virginia.

Distribution.—Eastern United States, south to the coast region of Georgia and the Gulf States.

Adult.—Pelage of two kinds of hair, an outer long coat of rather coarse white overhair, sufficiently abundant to give tone to the general coloration; beneath this a coat of long, thick, soft woolly underfur about 40 to 50 mm. long, on the back, white (sometimes nearly pure snowy white in clean winter specimens, but usually with a slightly yellowish cast) for four fifths of its length, the apical fifth of the longer fibres of the underfur being blackish. The long white overhair varies in abundance in different specimens and on different parts of the body, being nearly obsolete on the ventral surface, longer on the back than on the sides, and longest on the lower back and at the base of the tail, where it attains a length of 60 to 80 mm. General color above mixed black and white, the blackish tips of the underfur showing through the long overhair ; the white basal portion of the underfur also shows through the blackish surface of the underfur ; ventral surface white with a slight wash of dusky formed by the blackish tips of the hairs. There is generally a large pectoral area in adult males suffused with sulphur yellow, varying from a faint shade of this tint to quite strong greenish yellow, and varying also in respect to the size of the area. This pectoral spot is generally absent in young males and apparently always absent in the females. The fur over this area is often saturated with an oily, highly odorous secretion from underlying sebaceous glands, which are probably especially active during the breeding season. There is often a median ventral line of clear white, in both males and females, extending from the breast posteriorly, irregular in outline and extent in different specimens. Whole head, including the throat and sides of the neck, soiled white, or yellowish white, excepting the chin, which is usually darker and like the rest of the ventral surface. The sides of the neck are sometimes strongly tinged with buff. There is also a slight extension forward on the top of the head of the general dusky color of the dorsal surface, which usually forms a V-shaped area, extending to a point midway between the ears and eyes. It is indistinct in outline and varies greatly in intensity and extent in different individuals, being often absent, the head then being practically pure white. Eyes with a very narrow blackish eyering, widening anteriorly into a small, usually indistinct, preocular spot, sometimes nearly as large as the eye but often obsolete. Fore and hind limbs black the whole length except the toes, which on the fore feet are white for half or two thirds of their length, and on the hind feet for about one fourth their length. As a rule there is much less white on the hind toes than on the front toes, the hind toes frequently lacking the white on one foot and occasionally on both feet. The nails and soles of all the feet are yellowish or flesh-color in life. Ears black, broadly tipped with flesh color (pale yellow in the dry skins), or narrowly edged with this color, occasionally nearly or quite lacking. Tail clothed for about two inches at the base with long hair like that of the body, the naked portion brownish flesh-color, except at the base, where it is blackish ; the dark portion varies in extent in different individuals, but usually occupies only the part covered by the long hair. The pouch in the female is generally thickly lined with crinkled woolly hair, usually rufous brown.

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[1] *Didelphis nelsoni*, sp. nov., is not included; see postscript, p. 185.

Young.—Nursing young (250 to 350 mm. in total length) are blackish brown, finely grizzled with white hairs ; under surface scantily clothed with very short blackish hairs ; whole head clear white as far as the ears, with an incipient blackish eyering and anteorbital spot ; ears, *wholly white ;* feet and tail colored as in the adult. (See Plate XXV, Figs. 3, 4.)

Measurements.—Total length in middle-aged males, 750 to 875 mm. ; head and body, about 450 to 520 ; tail, about 270 to 350 ; tarsus, 60 to 70; ears, about 50. Females somewhat smaller. Ratio of tail length to length of head and body, about 70 or less. For further detailed measurements, including measurements of skulls, see Table I.

Specimens examined.— The material available for examination has been received from the following localities :

New York: Schoharie, 2; Fort Montgomery, 3; Highland Falls, 1; Hastings, 1; South Nyack, 1; Long Island, 4; New York City markets and Central Park Menagerie, 4, and 16 additional skulls (probably from Long Island and New Jersey).

Northern New Jersey: 6 adults and 10 young.

Pennsylvania: Erie, 1; Markelton, Somerset Co., 1.

Ohio: Garrettsville, 1 skin and 4 skulls; Wooster, 3 skulls.

Illinois: Warsaw, 1.

Maryland: Bethesda, 2.

Virginia: Dismal Swamp, 1; Dunn Loring, 2.

North Carolina: Hatteras, 4; Magnetic City, 1.

Tennessee: Big Sandy, 1; Clarkville, 1 skull; Danville, 1 skull; Roan Mountain, 1 skull.

Arkansas: Fayetteville, 2 skulls.

Missouri: Golden City, 1; Marble Cave, 1 (very young).

Kansas: Fort Leavenworth, 1; Cedar Vale, 3.

Indian Territory: Hartshorne, 2 adult and 6 very young; Savanna, 1; Red Oak, 2.

Oklahoma: Oklahoma City, 1.

Texas: Vernon, 1 skull; Gainsville, 1 skull; Brazos, Palo Pinto Co., 2; Kerrville, Kerr Co., 1 skull; Mason, 4; San Antonio, 6; Washington County, 1; Matagorda, 1; Deming Station, Matagorda Co., 3, and 1 skull; Virginia Point, Matagorda Co., 2; Velasco, Brazoria Co., 2.

Total 86, and 32 additional skulls.

Geographical Distribution.—So far as known the Opossum did not formerly range to the eastward of the Hudson River,[1] but of late years it has spread over Long Island and up the Hudson Valley as far as Schoharie, and is apparently not rare locally at various points in the lower Hudson Valley. It occurs also in the western part of New York, and thence westward, south of the Great Lakes, to Iowa, and thence southward to Texas. There are specimens in the present collection from eastern Kansas, Indian Territory, Oklahoma, and the Panhandle region of Texas, and as far south in the interior of Texas as Mason and San Antonio, and on the coast to about Matagorda Bay.

In the eastern United States it occurs locally, or at favorable points, from the Great Lakes southward nearly to the Gulf Coast and Georgia, merging in the southern part of its range into the southern darker form recently described by Mr. Bangs under the name *D. virginiana pigra*. Its range in Texas extends, in the interior at least, as far as San Antonio.

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[1] *Cf.* Miller, 'Preliminary List of New York Mammals,' in Bull. New York State Museum, Vol. VI, No. 29, Oct. 1899, pp. 293–295.

General Remarks.—Northern specimens (New York and New Jersey) are lighter in coloration and have softer and more abundant and whiter underfur than those from the Middle States and further southward; the blackish V-shaped area on the top of the head becomes better defined and the incipient dusky spot in front of the eye more pronounced in passing from northern localities southward. As shown by the tables of measurements given beyond (see Table I), there is apparently very little geographical variation in size; a large series of specimens might show a decrease in size toward the northern border of the range of the species. The specimens at hand show a wide range of variation in size, due apparently to age rather than to locality.

The few specimens from west of the Mississippi River (Kansas, Indian Territory, Oklahoma, and central and northern Texas) do not differ appreciably from specimens from New York, Ohio, Tennessee, Maryland, and North Carolina; but the material for comparison is too scanty to warrant positive conclusions.

Nomenclature.—The nomenclature of this species, both generic and specific, has of late been the subject of considerable discussion. An attempt was recently made[1] to discard the generic name *Didelphis* on the ground that the species, *D. marsupialis* Linn.—necessarily its type through the process of elimination—was indeterminable. By this ruling *Didelphis* Linn. (1758) was replaced by *Sarigua* Muirhead (1819), and *D. marsupialis* Linn. (1758) was disallowed as being unrecognizable. To both of these rulings the present writer has taken exceptions.[2] Mr. Oldfield Thomas[3] supports the retention of the name *Didelphis*,[4] but expresses his preference for "retaining the familiar term *virginiana* for the Virginia Opossum."

As to the proper specific name, however, the case is more complex. I have heretofore favored restricting the name *Didelphis marsupialis* of Linnæus to the Virginia Opossum, on the ground that the only reference given by Linnæus that is positively identifiable is his citation of Tyson, whose account is not only detailed and accurate, but is known to have been based on specimens brought alive to England from Virginia. Besides this, there is no question of the applicability of his description and figures to this animal. On the other hand Mr. Thomas (*l. c.*, p. 144) claims that Seba's account, cited also by Linnæus and having precedence in the order of citation, is also identifiable and relates almost beyond question to the large Opossum of Guiana and northeastern South America, later named *Didelphis karkinophaga* by Zimmermann. Linnæus's *D. marsupialis*, as every one admits, was intricately composite, including all of the then known forms of the restricted genus *Didelphis* from both North America (including Mexico) and South America. Unfortunately the first form of the group to receive a new name was the Guiana species, as above stated. The next to receive a name was the Virginia Opossum, called *Didelphis virginiana* by Kerr in 1792. We have still left of the Linnæan references the Tlacuatzin of Hernandez, which undoubtedly relates to the form of *Didelphis* occurring in Mexico. It has, therefore, seemed best to restrict *D. marsupialis* to the large Mexican Opossum, as suggested by Rehn (*l. c.* p. 149), retaining *D. karkinophaga* as the specific designation of the large Opossums of northeastern South America, and *D. virginiana* Kerr for the Opossums of the eastern United States, this course being not only warrantable, but scarcely disturbing the current nomenclature of the group. (*Cf.* also postea, p. 169.)

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[1] *Cf.* Rehn, Am. Nat., Vol. XXXIV, July, 1900, pp. 575–578.

[2] *Cf.* Allen, this Bulletin, Vol. XIII, 1900, pp. 185–190. In this article the date of Muirhead's genus *Sarigua*, as stated by Rehn, was claimed to be erroneous; that it should have been given as 1832 instead of 1819. As shown later, however, by Mr. Witmer Stone (Science, N.S. XII, No. 305, p. 685, Nov. 2, 1900), the correct date is 1819, as given by Mr. Rehn.

[3] Am. Nat., Vol. XXXV, Feb. 1901, pp. 144, 145.

[4] Mr. Rehn also in a late paper (Am. Nat., XXXV, Feb. 1901, pp. 147–149) admits the propriety of retaining *Didelphis* in place of *Sarigua*.

Kerr's name *Didelphis virginiana* was fortunately based on the "Virginian Opossum" of Pennant's 'History of Quadrupeds' and not on that of his 'Synopsis of Quadrupeds,' as in the latter case it would have been a pure synonym of *D. marsupialis* Linn. In the 'Quadrupeds' he so far modified the description first given in the 'Synopsis' as to make it not only strictly applicable to the Virginia Opossum, as regards coloration and the relative length of the tail, but he substituted a copy of Tyson's excellent plate of this animal for the very "indifferent" one in the 'Synopsis,' which represents a dark-headed, long-tailed South American form. There is, therefore, no ground for questioning the availability of Kerr's name, who simply paraphrased Pennant, even to his erroneous statement of its distribution.

Relationships.—*D. virginiana* merges gradually into *D. v. pigra* of the coast of Georgia, the Florida Peninsula, and the Gulf

Coast, diverging more perceptibly in Florida from the northern form, and reaching its extreme differentiation in the southern half of the Peninsula. South Florida specimens are, as already said, readily distinguished from New York and New Jersey specimens by strongly marked color differences, and perhaps by a slight average increase in the length of the tail.

In the Lower Rio Grande region of southern Texas there is apparently a rather abrupt transition from the *D. virginiana* type to the dichromatic form of the Lower Rio Grande region, both in coloration and in the relative length of the tail. Nevertheless it evidently diverges from the typical northern toward the southern animal near the southern border of its distribution in Texas.

Didelphis virginiana pigra *Bangs.*

Didelphis virginiana pigra BANGS, Proc. Boston Soc. Nat. Hist. XXVIII, 1898, 172. March, 1898.

Type locality, "Oak Lodge, on the east peninsula, opposite Micco, Brevard Co., Florida."

Distribution.—Florida, coast of Georgia, and Gulf Coast west to Texas.

Darker, but in all other respects similar to *D. virginiana*. The underfur has a much broader apical zone of black, the covering of white overhair is generally much reduced, the blackish face markings are more pronounced, the median extension of dusky on the head often extending as far forward as the front of the eyes, and the anteorbital spot is much larger. The white on the toes is much reduced, being often entirely absent on the hind toes, and the white on the apical border of the ears is often reduced to a mere trace; on the other hand the black at the base of the tail often extends considerably beyond the covered portion, particularly in South Florida examples, where there is also a tendency to melanism.

In measurements and proportions (see Table II of measurements) quite similar to *D. virginiana* of the northern States. In a series of 4 specimens from Kissimmee River, Fla., the ratio of tail length to length of head and body is 74.5.

D. virginiana pigra is not sharply or very strongly differentiated from *D. virginiana* (*typica*), but South Florida and Louisiana coast specimens are quite unlike the northern form through their much darker general coloration, the increase in extent and distinctness of the facial markings, a tendency to a greater extension of black on the base of the tail, and the reduction of white on the toes and ears.

Geographical Distribution.—*D. v. pigra* may be considered as occupying the whole of Florida, the lower coast region of Georgia, and the low Gulf Coast belt as far as western Louisiana. Specimens from the coast and interior of Texas, from about Matagorda Bay northward, seem better referable to true *D. virginiana.*

Specimens examined:

Georgia: Riceboro, 1; Beaufort Co., 5.

Alabama: Sylacuga, 4 skulls.

Mississippi: Bay St. Louis, 3.

Louisiana: Houma, 1; Lafayette, 1 skin and 1 adult skull.

Florida: Gainesville, 2; Lake Harney, 4; Fort Kissimmee, 2; Kissimmee River, 4—1 black; Little Marco, 1; Sebastian, 1; Key West, 1.

Total, 26, and 5 additional skulls.

Didelphis marsupialis *Linn.*

Tlacuatzin, HERNANDEZ, Anim. Mex. 1651, 330.

Didelphis marsupialis LINN. Syst. Nat. ed. 10, 1758, 54. (By elimination and restriction; see antea, p. 164.).

Didelphis californica BENNETT, P. Z. S. 1833, 40. Also of Baird and others.

Didelphis breviceps BENNETT, P. Z. S. 1833, 40.

Didelphys pruinosa WAGNER, Suppl. Schreber's Säug. III, 1843, 40 (footnote), and V, 1855, 224 (as a syn. of *D. californica*).

Type locality.—Mexico; exact point not known. Valley of Mexico, by restriction.

Gray Phase.—An outer long coat of white bristly overhair, 60 to 80 mm. long over the middle of the back and on the rump; beneath this a coat of soft long underfur, white for about two thirds of its length, the apical portion black, the long white overhair and the black outer zone of the underfur giving a dark grizzled general effect. Cheeks pure white, with generally a whitish spot over each eye, and a whitish area surrounding the base of the ears; whole top of the head and nose dusky brown, varying in intensity in different individuals, with a blackish stripe running from the ear through the eye to the nose. Fore and hind limbs black, including the feet except the nails, which are yellowish white; upper part of the limbs more or less grizzled with long white overhair. Beneath the pelage consists mainly of the soft underfur, which is much shorter and thinner than on the upper surface, with the tips of the fur more or less tinged with dusky, and with a few long bristly overhairs. Ears entirely black. Tail black at the base, usually for one half or more of its length, the apical portion flesh-color.

Black Phase.—Long bristly overhair black instead of white, beneath which is the usual soft long underfur, white for its basal two thirds and tipped with black. In other respects as in the gray phase.

During the breeding season the pouch of the female is lined with fine, crinkled, woolly hairs of a rusty chestnut brown color. During the non-breeding period the pouch hairs are often gray or even whitish.

In fresh pelage the underfur is nearly clear white or grayish white. Later it takes on a yellowish cast, sometimes becoming decidedly yellowish white, particularly on the head and anterior half of the body. The sides of the neck are often buffy, varying from pale buff to orange buff.

Young.—Above uniform black with generally a few white bristly hairs scattered over the dorsal surface. In very young specimens the underfur is dingy gray; as the animal increases in size and the pelage becomes longer, the underfur becomes white at base with a broad terminal zone of blackish. The head has a distinct color pattern, being white with a broad brownish black stripe running from the ear to beyond the eyes, and an extension forward over the top of the head of the blackish color of the body, terminating in a pointed area about opposite the eyes. In other words, the cheeks are white; there is a broad white spot at the inner posterior base of the ears, and a white band above the black band that runs through the eyes. The ears are entirely flesh-color to the base, changing gradually to black in the adult, the black usually beginning at the base and spreading toward the tips, but sometimes first appearing as dusky blotches irregularly dispersed. The feet and the basal portion of the tail are black as in the adults. (See Plate XXV, Figs. 1, 2.)

Measurements.—As shown by the measurements given in Table III, the total length of the animal ranges in adult specimens from 820 to 940 mm. in the male, and from 725 to 850 in the female. The adult skull ranges in total length from 112 to 136 in the male, and from 103 to 120 in the female. The ratio of length of tail to that of the head and body is generally between 85 and 90.

Specimens examined:

Tamaulipas: Alta Mira, near Tampico, 4 specimens—2 in black phase, 2 in gray phase; also 1 additional skull.

Nuevo Leon: Monterey, 4,—1 black, 3 gray.

Chihuahua: Batopilas, 1, black.

Sonora: Hermosillo, 1, black.

Sinaloa: Sierra de Choix, 1, gray; Culiacan, 1, black; near Mazatlan, 2—1 black, 1 gray; Rosario, 1, gray; Escuinapa, 1, black.

Durango: Chacala, 1, black.

Zacatecas: San Juan de Capistrano, 1, gray.

Tepic: Tepic, 2—1 black, 1 gray.

Jalisco: Ameca, 2 skulls; Atemajac, 2, gray; Zapotlan, 1, gray; San Sebastian, 1, black; Etzaplan, 11,—all very young, in first (black) pelage; Guadalajara, 8, all gray, and 29 young, one fifth grown, in alcohol.

Colima: Armeria, 6—4 black, 2 gray; Manzanillo, 9, all black; also 3 additional skulls from Armeria and 7 from Colima.

Michoacan: Querendaro, 3, gray; Patzcuaro, 1, gray; Hacienda El Motino, 2, gray.

Guanajuato: Celaya, 1, black.

Queretaro: Jalpan, 1.

Hidalgo: Pachuca, 2, and 3 additional skulls; Rio del Monte, 1; Ixmiquilpan, 1; Tulancingo, 1, young; all the adults are in gray phase.

Mexico: Tlalpan, 3; Ameca, 1; Salazar, 1; all in gray phase.

Morelos: Yautepic, 1, gray.

Puebla: Atlixco, 2; Metlaltoyuca, 2; Chalchicomula, 1; Huanchinango, 1; San Marten, 1 (and 1 additional skull); all in gray phase.

Vera Cruz: Jico, 1, black; Las Vegas, 1, gray; Maltrata, 1; Minatitlan, 2; Orizaba, 2, gray, and 2 additional skulls.

Guerrero: Acapulco, 6—4 black, 1 gray, and 1 pure albino.

Oaxaca: Tuxtepec, 2 gray, 2 very young, and an additional skull; Cuicatlan, 1, gray; Oaxaca, 1, gray; Reyes, 3 gray, and 1 skull; San Domingo, 1, black; Tehuantepec, 2—1 black, the other gray.

Total, 106 skins, 22 additional skulls, and 29 young in alcohol.

Geographical Distribution.—The northern limit of the range of the *D. marsupialis* (= *californica* auct.) group begins on the coast of Texas near Nueces Bay, and doubtless occupies the coast region thence southward to Guatemala, and the interior tablelands across Central Mexico to the Pacific Coast, ranging on the west coast from the southern part of Sinaloa to Guatemala. The northern limit of its range in Mexico has not been definitely ascertained, but there are no specimens in the present collection from the northern tier of States, except from near their southern border. The most northerly points represented are Monterey, in Nuevo Leon; Hermosillo, in central western Sonora; and Sierra de Choix in the extreme northern part of Sinaloa. There is no record of the occurrence of any form of Opossum along the southern border of the United States west of Texas, the early vague references to the occurrence of *D. californica* in California being unsupported by modern research.

The number of specimens of this group at present available for study is about 220. Large portions of Mexico that are doubtless inhabited by this animal are entirely, or almost entirely, unrepresented, as, for example, the State of Tamaulipas, from which there are only a few specimens, from the vicinity of Tampico. Nuevo Leon is represented by only four specimens, from Monterey. There are none from Coahuila. Chihuahua is represented by a single specimen from near Batopilas, and Sonora by a single specimen from Hermosillo. The specimens from Sinaloa are all but one from near the coast of the southern portion. Several of the interior States also are practically unrepresented, as San Luis

Potosi, Durango, Guanajuato, and Queretaro, these States being each represented by a single specimen. There are numerous specimens from several points along the western coast, as Acapulco, Manzanillo, Colima, Armeria, and Mazatlan.

As shown later, a separable form occupies the Lower Rio Grande Valley, and another the coast region of Vera Cruz, Tabasco, and Chiapas.

Nomenclature.—As already shown (p. 164), it seems best to adopt, by the usual method of elimination for composite groups, Linnæus's name *D. marsupialis* for the large Mexican Opossums, considering the name as tenable on the basis of the Tlacuatzin of Hernandez, cited by Linnæus. While no definite type locality can be assigned, we may assume it to be that portion of Mexico known to Europeans at the middle of the seventeenth century, and hence assume as the type locality the region about the city of Mexico. The name heretofore usually employed has been *Didelphis californica* Bennett, based on a specimen "from that part of Mexico which adjoins California." The specimen was collected by Douglass on his journey across Mexico, but no definite localities have ever been given for the types of the various species of mammals based on the collections made by him during this trip. If they were taken in northwestern Mexico, as generally supposed, they must have been obtained from localities quite remote from the present State of California.

Mr. Bennett described in the same paper a *Didelphis breviceps*, also based on a specimen collected by Douglass. The alleged differences in respect to the proportions of the head with reference to the position of the ear might easily be due to bad taxidermy. In other respects the two alleged species agree very well for animals of this group. *D. pruinosa* Wagner was described from a specimen from "Mexico," no definite locality being indicated.

The specimens on which these supposed species were based were all in the gray phase of pelage, and are characterized by the great length of tail peculiar to the large Mexican Opossum. *D. breviceps* and *D. pruinosa* must apparently be construed as pure synonyms of *D. californica*, which name is here referred to *D. marsupialis* Linn. (restr.).

The *D. marsupialis* group, as thus restricted, is separable into several geographical races or subspecies, some of which can be predicated on the basis of the present collection, while doubtless others will be made known later when a much larger amount of material, covering more completely the range of the group, and embracing proper series from a large number of localities, becomes available for elaboration. None of the names above cited can refer to any of these forms, but should the animal of the west coast of Mexico prove to be separable from that of the interior, as seems not improbable, Bennett's name *californica* may be employed for it, as it seems likely that Bennett's specimens were obtained there by Douglass.

Relationships.—It seems preferable to treat the Mexican *D. marsupialis* group as specifically separable from *D. virginiana* of the United States, although the characters that distinguish the two are mainly differences of degree, or comparative rather than absolute. The chief features of distinction between the two forms, are (1) the greatly increased length of tail in the *D. marsupialis* group, with the basal half, instead of only the extreme basal portion, black; (2) absence of white on the toes; (3) absence of white on the ears, although a slight white edging seems liable to crop out sporadically throughout the range of the species; (4) the increased width of the apical black zone of the underfur, which gives even in the gray phase a darker general effect to the coloration; and (5) the grayish dusky color of the whole front of the head, including the top and sides of the nose, and the presence of a well developed ocular stripe. In respect to the characters of the skull, the Texas specimens of the *D. marsupialis* group do not seem to differ appreciably from specimens of *D. virginiana* from central and northern Texas and elsewhere in the United States.

The relationship of *D. marsupialis* to the southern forms of the genus cannot be satisfactorily determined, owing to insufficient material from Central America. A series of four specimens from Nicaragua, however, and a few from Costa Rica, indicate an animal quite different from *D. marsupialis*, through its more slender form, as shown in the total length of the animal, in the higher ratio of tail length to that of the head and body, and in the narrower and longer skull, and also in the pointed form of the posterior border of the nasals. (See Plate XXIII, Fig. 5, and Plate XXIV, Fig. 3.)

Moult, and Variation with Age and Season.— In young specimens the first pelage consists of very short woolly hair, at first almost wholly blackish. As the hair increases in length it becomes lighter at the base, and later nearly pure white for about two thirds of its length. When the animal is a few weeks old the long coarse overhair begins to appear, being white or black according to the phase. By the time the animal is one fifth grown its pelage is similar to that of the adult and there is no further change except what results from fading and wear.

The present series of specimens does not afford satisfactory material for a complete study of the moult. From October till February the pelage is generally full and long. In March it often shows signs of wear, and by April becomes exceedingly worn and ragged. At the same time new hair can be seen coming in, at first in patches where the old pelage has been removed by accident. April and May specimens generally show new hair coming in, but whether a full summer dress is acquired remains uncertain. Through individual idiosyncrasy specimens occur sporadically from January to July that are very much worn, but in general there appears to be a renewal of the coat in April and May. August to September specimens also show new growth of hair, which continues to come in, at least in certain specimens, till late in October. By the end of October the full winter coat has generally been attained. It is interesting to note that the underfur in the new fresh coat is often nearly clear white, this condition occurring at widely separated localities. Later the underfur commonly takes on a slightly yellowish cast, which becomes more pronounced as the season advances, so that specimens in worn condition often have the underfur decidedly yellowish white, and the white overhair is often soiled or stained dingy yellowish. Quite a number of specimens, from various and widely separated localities, have the underfur of the head, neck, and shoulders quite deep buff, and the rest of the underfur more buffy than usual, due apparently to adventitious staining.

Dichromatism.—The large Mexican Opossums of the *Didelphis marsupialis* group are, like those of the *D. karkinophaga* group, subject to dichromatism, they presenting a gray phase and a black phase similar to the gray and black phases so well known to occur in various species of Squirrels. While the two phases appear to be somewhat localized, they often occur together, specimens of each being collected at the same localities at practically the same dates. In the black phase the long overhair is black, but of about the same length and coarseness as the white overhair in the gray phase. The white overhair is more conspicuous owing to its contrast with the black surface of the underfur. In only a few instances do we meet with a mixed condition in which both coarse black and white hairs are intermixed. In such instances the white hair is very scanty and scattered. The gray phase appears to predominate throughout the interior of Mexico, including the whole tableland region, whence very few black specimens are represented in the present series. On the other hand, in the lower Rio Grande region of Texas, and along the eastern coast of Mexico, from southern Tamaulipas southward, and along the whole west coast from Guatemala to Mazatlan, the black phase is common, and at some localities appears to predominate.

Didelphis marsupialis texensis, subsp. nov.

Type, No. $\frac{33133}{45137}$, Biol. Surv. Coll. U. S. Nat. Mus., ♂ ad., Brownsville, Texas, April 13, 1892 ; F. B. Armstrong.

Similar in coloration to *D. marsupialis* (*typica*), but with a relatively longer tail, longer nasals, usually terminating posteriorly in an acute angle, instead of being rounded or more or less abruptly truncated on the posterior border.

Measurements.—Type, total length, 820 mm.; head and body, 410 ; tail, 410 ; tarsus, 70 ; ear, 50. Adult males range in total length from about 780 to 820 mm., and adult females from about 700 to 730 mm. The ratio of tail length to the length of head and body ranges, in normal specimens, from about 85 to 100. (For additional measurements see Table IV.)

Skull.—The nasals, with individual exceptions, terminate posteriorly in a pointed angle, the portion anterior to the point of greatest expansion being as long as, or a little longer than, the anterior half of the basal rhomboid.

Geographical Distribution.—The coast region of Texas, from Nueces Bay southward, and the Lower Rio Grande Valley, as far up the valley at least as Del Rio, Val Verde County. Sporadically northward to San Antonio, at which point *D. m. texensis* occurs with *D. virginiana*, the latter greatly predominating. It doubtless ranges somewhat to the southward of the Rio Grande, but there are no specimens available for examination from between Brownsville and Tampico.

Dichromatic, the black phase, in the material examined, prevailing in the ratio of five to one of the gray phase, as shown by the following record of

Specimens examined :

Texas : San Antonio, 2, black phase ; Rockport, 3—2 in black phase, 1 in gray phase; Corpus Christi, 4, black phase; Nueces Bay, 2, black phase Alice, 1, black phase; Sycamore Creek, 1, black phase; Del Rio, 2—1 in black phase, 1 in gray phase; Eagle Pass, 1, black phase; Fort Clark, Kinney Co., 8—4 black and 4 gray; Brownsville, 6—3 in black phase and 3 in gray phase. Also additional skulls.

Mexico: Matamoras, 1.

Total, 31, and 7 additional skulls.

Didelphis marsupialis texensis differs markedly from *D. virginiana* in the color and markings of the head, and in its much longer tail, but presents no notable cranial differences. It differs from *D. marsupialis* in the form of the nasals, in its somewhat longer tail, and in the great predominance of the black phase, the prevailing phase in *D. marsupialis* being gray.

Didelphis marsupialis tabascensis, subsp. nov.

Type, No. 100512, Biol. Surv. Coll. U. S. Nat. Mus., Teapa, Tabasco, Mexico, April 7, 1900; E. W. Nelson and E. A. Goldman.

A long-tailed form, with very long nasals, terminating posteriorly in a somewhat pointed angle. Apparently not very different in coloration from *D. marsupialis* (*typica*). Based primarily on seven specimens from Teapa and Frontera, Tabasco, to which are typically referable two from Papantla, three from Catemaco, and five from Mirador, Vera Cruz; also 25 from various localities in Chiapas and Guatemala, and 5 from Merida, Yucatan. Of these specimens rather more than one half represent the black phase. The February specimens are in fairly good winter pelage; the others, which were nearly all taken in April, are more or less worn. In many of the specimens the underfur, the sides of the neck, and the cheeks are more or less yellowish, in some of them strongly so, and in the Mirador specimens the buff tinge is especially strong, being deep buff on the head, neck, and front half of the body, and pale buff on the posterior half. Apparently, however, this strong buff tint is due to adventitious staining.

Measurements.—Type, total length, 902 mm.; head and body, 460; tail, 442; tarsus, 69; tail ratio, 96. Six males range from 850 to 919 in total length, and 415 to 463 in tail length, with a tail ratio of 95 to 107. Four females range in total length from 811 to 886, and from 368 to 431 in tail length, with a tail ratio of 95 to 112. (For further measurements, including measurement of skulls, see Table V,

Specimens examined:

Tabasco: Teapa, 5—3 black, 2 gray; Frontera, 2, black, and 1 skull.

Vera Cruz: Mirador (near Vera Cruz), 5—1 black, 4 gray, and 1 skull; Catemaco, 2—1 black, 1 gray, and 1 skull; Papantla, 2, gray.

Chiapas: Tumbala, 4, gray; San Cristobal, 1, gray; Ocozuatlan, 1 gray; Tajalon, 1, gray; Valley of Comitan, 1, gray; Ocuilapa, 1, gray;

Huehuetan, 7—3 black, 4 gray, and 3 additional skulls; Tuxtla, 5—1 black and 4 gray.

Guatemala (near Chiapas border): Jacaltenango, 3, black; Nenton, 1, gray; Escondido River, 1, very young; "Guatemala," without special locality, 4—3 gray, 1 black.

Total, 46 and 5 additional skulls.

Didelphis marsupialis tabascensis is a very strongly marked form, ranging, so far as present material shows, from the vicinity of Vera Cruz to Frontera, Tabasco, and across the State of Chiapas to northern Guatemala. The character of the long nasals, terminating posteriorly in a V-shaped angle, runs throughout the series with a small number of exceptions, while the specimens from the immediately adjoining localities to the northward and westward, in the States of Vera Cruz and Orizaba, are almost uniformly characterized by short nasals more or less truncated posteriorly. The form of the nasals is thus much as in *D. virginiana* and *D. m. texensis*, or even in *D. richmondi* from Nicaragua and Costa Rica. The increase in the length of the nasals, in this as in other forms with long nasals, is not due to any increase in the length of the rostral portion of the skull but to the greater posterior extension of the nasal bones.

The variation in the form of the nasals in *D. marsupialis* and its subspecies is summarized, in comparison with *D. virginiana*, in the following tabular statement:

Ratio of Nasals to the Basal Length of Skull.

	No. of Specimens.	Locality.	Ratio.
D. virginiana	32	Northern United States	51
D. v. pigra	16	Florida	50.4
D. marsupialis	4	Tamaulipas	47
" "	7	Oaxaca	45.6
" "	1	Puebla	48.7
" "	6	Hidalgo	49.1
" "	7	Guerrero and Michoacan	47.9
" "	15	Colima	47.5
" "	10	Jalisco	46.3
" "	6	Sinaloa	49
D. m. texensis	15	Rio Grande Valley, Texas	50.5
D. m. tabascensis	14	Vera Cruz (coast region)	50.8
" " "	7	Tabasco	51.2
" " "	9	Chiapas	51.3

Didelphis richmondi, sp. nov.

Type, No. $\frac{33136}{45140}$, U. S. National Museum, ♀ adult, Greytown, Nicaragua, Feb. 7, 1892; collected by Dr. Charles W. Richmond.

Adult.—The long bristly overhair is black and yellowish white, that of the nape and shoulders mainly black, in contrast with that of the rest of the dorsal surface; generally the white overhair is more abundant than the black; underfur coarse, yellowish white for the basal two thirds tipped with black; extreme basal half dingy greenish orange; sides of the head to the posterior base of the ears soiled pale buffy white, separated by a distinct median stripe of black running forward to a little beyond the eyes; an ocular band of blackish, running from the ear to the base of the whiskers; cheeks soiled buffy white; underparts with the pectoral area, including the sides of the neck, buffy at the surface, with the pelage brownish yellow of the basal two thirds; legs and feet black; nails yellowish white; ears wholly black; tail with the basal half black, the rest flesh-color.

Young.—A young specimen, about one fourth grown, is similar to the adult, except that the coarse overhair is more abundant, and it presents the same contrast of black predominating anteriorly and yellowish white posteriorly. The underfur is stained deep orange buff as in the adult; lower parts deeper buff than in the adults without the dusky tipping to the hairs.

Measurements of type.—Total length, 948 mm.; head and body, 471; tail, 477; tarsus, 70. Skull, total length, 114; basal length, 104; nasals, 54; zygomatic breadth, 55; length of palate, 65; upper toothrow, 37.4. (For additional measurements see Table V.)

This species is based on four skins with skulls and two additional skulls, from Greytown, Nicaragua, collected by Dr. Charles W. Richmond, for whom the species is named. The skins comprise three adult females and a young male about one fourth grown. Three of the specimens are quite similar in coloration, having a well defined median black stripe on the head and a dusky stripe from the ear through the eye to the base of the whiskers, between which markings the color is pale buffy white. Another adult in very worn pelage is similar in markings, but almost entirely lacks the long overhair, which has apparently been worn off. I also refer here two very young specimens from Costa Rica, formerly identified by me as *D. aurita*, on account of the yellow color of the ears, and also six adults from Costa Rica, collected by the late Dr. Gabb near San José.

Didelphis richmondi differs from *D. marsupialis* in the more slender form of the skull, which is long and narrow, with very long nasals, and in the great length of the tail. It also differs in the dull greenish orange-buff color of the basal portion of the underfur; also in the very strongly defined median black stripe running over the top of the head from a point a little in front of the eyes to the occiput, and in the nape and shoulders being nearly black in contrast with the rest of the dorsal surface, the coarse overhair being almost wholly black on the anterior portion of the body and mainly whitish on the posterior. The amount of black at the base of the tail varies from about one third to two thirds of the total length of the tail. The ratio of tail length to the length of head and body averages, in the three adult specimens, 112, while the ratio of the length of the nasals to the basal length of the skull is 53.5.

In short, *D. richmondi* is much more closely related to the *D. karkinophaga* group than to *D. marsupialis*, sharing with the members of the *karkinophaga* group the dingy orange-buff color at the base of the underfur. In general features *D. richmondi* most closely resembles *D. k. caucæ* from the upper Cauca Valley of western Colombia, but differs from this form in its much larger size and slenderer form, the relative length of the nasals and tail in *D. caucæ* being nearly the same as in *D. marsupialis*.

NOTE ON *Didelphis pernigra*.

In this connection it may be added that the distinctness of *D. pernigra* from all other forms of *Didelphis* is emphasized by this further study of the group, its distinctive features being, as already stated, its small size, very long tail, peculiar coloration and pelage. The black overhair of the pelage in *D. pernigra* is less stiffened than in the other forms of *Didelphis* and hardly corresponds in coarseness and harshness to the overhair in the other forms of the genus. To emphasize its differences in size and proportions, a table of measurements (see Table VI) and also illustrations (Pl. XXIV, Figs. 1–1*a*) are added for comparison with the other forms.

It has also become evident that dichromatism prevails in the various forms of the *D. karkinophaga* group, at least so far as those of northern South America are concerned, though not before recognized. It occurs in the Trinidad form, provisionally taken to represent *D. karkinophaga*, in the absence of satisfactory material from Guiana; it occurs also in *D. k. colombica*, where, however, the black form prevails; and also in *D. k. caucæ*, where the two phases are about equally represented. It has heretofore been very difficult to account, for example, for the occurrence of black and gray specimens among the very young specimens as well as among the adults, but from this point of view the matter becomes very simple. The type of *D. caucæ*, it may be added, is a specimen in the gray phase, while the type of *D. colombica* is a worn specimen in the black phase.

EXPLANATION OF THE TABLES OF MEASUREMENTS, ETC.

All the measurements are in millimetres. In measuring skulls the total length is taken from the front border of the premaxillaries to the posterior border of the occipital crest. In young animals, which have just acquired $m^{\underline{4}}$, this is often less than the basal length, but in animals more advanced in age, and especially in very old individuals, it exceeds by about 10% the basal length. Basal length, in the present paper, is the basal length of Hensel, and is taken from the inner base of the upper incisors to the front border of the foramen magnum. The other skull measurements require no special explanation.

In all skulls of which measurements are tabulated the fourth molar has reached its full development. In the 'sex and age' column ad. y. = young adult; ad. m. = middle-aged adult; and ad. o. = very old adult.

The external measurements are in every case those taken by the collector from the fresh specimen. In most cases only three measurements appear to have been taken, namely, the total length, the length of the tail, and the length of the tarsus. For purposes of comparison, and in the computing of ratios, it has been found convenient to separate the length of the head and body, which is found by subtracting the tail length from the total length.

The source of the material used is indicated by prefixing to the numbers the letter A to distinguish the specimens from the American Museum of Natural History. All those not thus distinguished are from the Biological Survey Collection in the United States National Museum, Washington, D. C.

In the case of fractional numbers, the number above the line refers to the skull and the number below the line to the skin.

POSTSCRIPT

Since this paper was put in type I have received through the kindness of Dr. C. Hart Merriam, Chief of the Biological Survey of the United States Department of Agriculture, five specimens of *Didelphis* collected by Messrs. E. W. Nelson and E. A. Goldman, at Chichenitza, Yucatan, and Apozote, Campeche, during January and February, 1901. These specimens, with others from Merida, Yucatan, indicate a form distinctly separable from any heretofore recognized. It may be characterized as follows :

Didelphis yucatanensis, sp. nov.

Type, No. 100299, Biol. Surv. Coll., U. S. Nat. Mus., ♂ adult, Chichenitza, Yucatan, Jan. 29, 1901 ; E. W. Nelson and E. A. Goldman.

Nearest in size and external features to *D. caucæ*, but much smaller. Coloration and character of pelage not especially distinctive. Dichromatic, both the black, and the gray phase being about equally represented. Nose and nails flesh color ; ears, feet, and basal half to three-fourths of tail black. Size, very small, intermediate between that of *D. caucæ* and *D. pernigra*, and hence a pigmy in comparison with *D. richmondi* and the various members of the *D. marsupialis* group, which widely separate it geographically from *D. caucæ*, which latter is also much larger than *D. yucatanensis*.

External Measurements.

Nat. Mus. No.	Locality.	Sex.	Total length.	Head and body.	Tail.	Tarsus.	Tail ratio.
108296	Apazote, Campeche. .	♂ juv.	685	373	312	58	83
108297	" " . .	♂ juv.	634	312	322	54	103
108298	Chichenitza, Yucatan.	♂ ad.	756	363	393	60	108
108299	" "	♂ ad.	680	364	316	60	87
108300	" "	♀ ad.	697	327	370	55	113

Measurements of Skulls.

Nat. Mus. No.	Sex.	Total length.	Basal length.	Nasals, length.	Zygom. breadth.	Mastoid breadth.	Palatal length.	Tooth-row.	Molar series.
108298[1]	♂	100	90	46	48	29.4	52	34	19
108299[1]	♂	99.5	89.5	42	51.6	30	55	34.6	19
108300[1]	♀	88	81.5	40	42	26	52.5	33	19.3
13476[2]	♂ ad.	106	95	46.5	56	31	54	36	20
$\frac{37938}{11423}$[2]	♂ ad.	104.6	—	46	57.6	32.3	55	32	18
$\frac{37939}{11425}$[2]	♂ ad.	103.3	—	46.3	53	30	55.6	34	19

[1] Chichenitza, Yucatan. [2] Merida, Yucatan.

This species is based on three specimens from Chichenitza, Yucatan (the type locality), four from Merida, Yucatan, two from Apazote, Campeche, and one labeled simply "Campeche." All are fully adult, with the crests of the skull highly developed and the teeth more or less worn, except the Apazote specimens, in which m $\underline{4}$ is in sight but not fully grown. Of these ten specimens five are in the gray phase and five in the black phase of coloration. The skins give the impression of a small, slender, delicately formed animal, a feature well borne out by the skulls.

Didelphis yucatanensis appears to be a very distinct form, characterized especially by its small size, as compared with *D. tabascensis*, found in the adjoining portions of Mexico and in Guatemala, and *D. richmondi* of Nicaragua, by which it is geographically isolated from the small forms occurring in western Colombia and Peru. It differs in the form of the nasals from true *D. marsupialis*, which are pointed posteriorly instead of being bluntly obtuse or more or less truncated on the posterior border. In other words, they are of the usual or normal form for the genus, as seen in *D. virginiana*, *D. richmondi*, and *D. tabascensis*, etc.

I.—DIDELPHIS VIRGINIANA.

Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. proc.	Postorb. constric.	Mastoid br'dth.	Br'dth at canines.	PALATE.			Toothrow.	Molar series.	EXTERNAL MEASUREMENTS.				RATIOS.			
					Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at $m^{\underline{4}}$, outside.	Br'dth at $m^{\underline{4}}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
A$\frac{7378}{9071}$	Elizabeth, N. J.	♂ ad. y.	113	101	53	18	5.3	63.5	26	12	35	21	62	35	21	38.5	21	—	—	—	—	—	52.5	61	62.9
A316	Miller's Place, N. Y.	♂ ad. m.	128	115	62	22	7.5	72	29	11.5	37	24	68	35	21.5	40	21	—	—	—	—	—	54	59	62.6
A2855	Long Island, "	♂ ad. m.	114	104	53	17	5.4	62.5	25	12	33	20	63	34	22	39.5	22	—	—	—	—	—	51	65.8	60
56569	Montauk Point, "	♀ ad. m.	114	104	54	17	5.5	56.5	23.7	11.3	32	18	63	34	21	39	21.5	730	475	255	65	63	52	65.8	54.3
A317	Miller's Place, "	♀ ad. y.	105	94	51	18	5.3	56	22	11	31	18	58	34	20	38.5	22	—	—	—	—	—	54	62	59.5
A16608	Schoharie, "	♂ ad. m.	118	105	56	21.5	6	—	26	11.5	34.6	21.7	65	34	21.5	—	—	—	—	—	—	—	51	62	59.5
A16664	Fort Montgomery, N. Y.	♂ ad. m	115	104	54	19	6	60	24.3	11	33.4	20	65	34	19.5	41.6	23	—	—	—	—	—	52	62.5	57.7
A1175	Garrettsville, O	♂ ad. y.	115	106	56	22	7	65	27.4	11	35	20	64	34	20	40	22	—	—	—	—	—	51	60	61.3
A1176	" "	♂ ad. m.	118	110	58	19	6	63.5	24.5	11	36	21	65	35	20	41	23	—	—	—	—	—	52.7	59	56.8
A1173	" "	♀ ad. m.	118	109	54	17	6	62	24	12	37	20	67	36.5	24	42	21	—	—	—	—	—	50	61.5	57
$\frac{47132}{34867}$	Golden City, Mo.	♀ ad. m.	118	108	48	17.5	5.5	57	24	11.6	32.5	18	61	32	19	38	20.7	774	469	305	69	61	44.4	56.5	50
$\frac{48523}{36179}$	Hartshorne, I. T.	♀ ad. m.	105	96	50	16	5.4	56.3	24	13	32	17.5	60	34	20	39.5	21.3	750	435	315	65	73	52	62.4	59
A16594	Hatteras, N. C.	♂ ad. m.	131	116	61	20	6	69	27.5	11	39.5	23	70	37	24	41	23	871	518	353	65	64	52.6	60.3	59.5
A16595	" "	♂ ad. m.	124	—	56	22	7	70	29	12	38	22	67.5	33	20	40	21	640	370	270	65	73	—	—	—
$\frac{45058}{33060}$	Riceboro, Ga.	♀ ad.	117	100	51	18.5	5	57	25	13	33	18	61	33	20.5	40	22	747	437	310	66	70	51	61	57
46895	Danville, Tenn.	♂ ad. o.	122.5	111	56	20.5	5	69	28	11.5	34.3	22.3	65	35	21	39	22	785	465	320	52	71	50.4	58.6	62
47768	Clarkville, Tenn.	♀ ad. m.	111	102	51	18	5.5	59	25	12	34	20	64	35	22	40	21	750	440	310	60	70	50	62.7	57.8
$\frac{47129}{34864}$	Big Sandy, "	♀ ad. m.	106	99	49	17	5.7	57	23	12	33	19	60	34	20.5	38	21	740	430	310	66	72	49.4	61.6	57.5
A$\frac{8652}{10339}$	San Antonio, Texas	♂ ad. m.	120	113.5	55	20	7.5	69	26	13	36.6	24	64	33	19	38	21.3	—	—	—	—	—	48.4	56.3	66.6
A$\frac{8653}{10340}$	" "	♂ ad. m.	129	118	60	21	7	66	30	12	38	23.7	71	32	20	42.5	22	864	472	394	75	71	50.8	60	56
A$\frac{8651}{10338}$	" "	♂ ad m.	125	114	59	22.3	6	63	30	12	38	24	70	36	21	41	22	787	482	305	70	70	52	61.4	55.2
A14827	" "	♀ ad. m.	118.5	100	50	17	6	55	22	11.5	33.5	20	61	33	22	39	21	—	—	—	—	—	50	61	55
A$\frac{8654}{10341}$	" "	♀ ad. m.	117.5	103.6	54	18	6	62	24	11	35	20	63	33	19.5	34.5	21	—	—	—	—	—	52	60.8	59.8
A8804	" "	♀ ad. m.	119	109	56	22	8	61.6	28	12	34	20	67	34	19	39.5	22	—	—	—	—	—	51.4	61.5	56.5
97149	Virginia Point, Galveston Co., Texas	♂ ad. m.	131	119	59	20	8	65	26	11	36	26	70	35	21	40	22	830	480	350	80	73	50	59	54.6

I.—DIDELPHIS VIRGINIANA (concluded).

Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	Br'dth at canines.	PALATE.			Upper toothrow.	Molar series.	EXTERNAL MEASUREMENTS.					RATIOS.			
					Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at $\mathrm{m}^{\underline{4}}$, outside.	Br'dth at $\mathrm{m}^{\underline{4}}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Ear.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
44961	Dickinson Bay, Galveston Co., Texas	♀ ad. m.	116	105.5	55	20	6	61	28	11.4	35	24.5	66	—	—	40.5	21	820	500	320	62	—	64	52	62.5	57.9
65057	Vernon, Wilbarger Co., Tex.	♂ ad. m.	128	116.5	58	22	7.7	72	29	11	39.5	24	68	35	21	41.5	23	—	—	—	—	—	—	50	58.4	61.8
44833	Velasco, Brazoria Co., "	♀ ad. o.	116	105	52	16.5	5	58	22	12	34	19	65	32	19	37	20	—	—	—	—	—	—	49.4	62	55.2
44268/32432	Deming Station, Tex.	♂ ad. y.	112	103	52	17	6	60	24	11	34	21	61	34	—	41	22	770	470	300	66	—	64	50.5	59.2	58.2
44266/32430	" "	♂ ad. y.	111	103	50	18.6	6.5	59	23.7	11.5	33.5	20.7	61	33	20	39.5	21	770	450	320	76	—	71	48.5	59.2	57.2
44269/32433	" "	♀ ad. m.	109	98	50	18	6	55.5	21.4	12	32.5	18	60	33	19	38.3	21	770	468	302	70	—	65	51	61.2	56.6

II.—DIDELPHIS VIRGINIANA PIGRA.

Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	Br'dth at canines.	PALATE.			Upper toothrow.	Molar series.	EXTERNAL MEASUREMENTS.					RATIOS.			
					Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at $\mathrm{m}^{\underline{4}}$, outside.	Br'dth at $\mathrm{m}^{\underline{4}}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Ear.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
97096	Iowa Station, La.	♂ ad. m.	124	112	57	20	6	66	29.3	11.4	37	24	66	34	21	40	22	—	—	—	—	—	—	51	50	50
99970	Calcasieu Pass, La.	♂ ad. m.	120	100	50	16	6	55	23	11	33	18.6	62	32.5	19	39	21	—	—	—	—	—	—	50	62	55
46043	Houma, La.	♂ ad. m.	115	107	51.5	11	6	62	22	10.5	35	22	64	32.5	20	37	20	—	—	—	—	—	—	48	60	58
46389/34298	" "	♀ ad. y.	107	97	48	18	6	54	23	12	30	19	60	32	20	38.5	21	690	404	286	60	—	71	49.6	62	55.6
46381	Lafayette, La.	♀ ad. m.	108	97	47	16	5.5	52	21.7	11.5	31.5	17	61	30	18	39.5	21	751	417	334	66	—	80	47.4	63	53.6
45401/33126	Bay St. Louis, Miss.	♂ ad. m.	131	115	60	20.7	7	69	26	11	35.9	24	68	35	20	40	22	825	495	330	75	—	67	52	59.2	60
45884/33849	" " "	♀ ad. m.	110	101	52	17	6	56	20	11.8	31	19	61	33	20	38	21	765	445	320	70	—	74	51.5	60.4	55.4
44057	Sylacuga, Ala.	♂ ad. m.	117	107	55	17	6.5	62	25	12	35.5	20	68	33	—	41	22	—	—	—	—	—	—	51.4	63.5	58
44058	" "	♀ ad. m.	105	96	49	16	6	—	22	11	35	22	59	31	—	40	21	—	—	—	—	—	—	51	61.5	—
71753	Key West, Fla.	♀ ad. m.	103	95	45.5	17	6.5	54	22	11	33	19	53	31	19.5	38	22	714	422	292	66	—	70	48	55.8	51.6
63998	Fort Kissimmee, Fla.	♂ ad. m.	121	111	54	19	6.5	62	27	12	35	19.5	67	34	20.5	39.5	21	—	—	—	—	—	—	49.6	60.4	55.9
63997	" "	♂ ad. m.	122	110	58	19	6	61	25.5	12	35	22	67.5	33.5	20	41	22	—	—	—	—	—	—	52.7	61.4	55.5
79116	Lake Harney, "	♂ ad. m.	122	111	58	19	6	63	24	12	37	22	66	34	20	40.5	22	793	482	311	63	56	64	52.2	60	56.8
79113	" "	♂ ad. m.	115	105	55	15	5.7	52	22.3	11	33.7	19	65	32	19	39	21	816	480	336	63	53	70	52.4	62	49.6
79114	" "	♀ ad. m.	106	96	48	16	5	51	21.5	11.7	30	17	60	31	19.5	38.5	21	718	431	287	63	56	67	50	61.5	53
A14335	Henderson Camp, Fla.	♂ ad. m.	121	—	55	21	7	64.5	25	11.5	35	22	67.5	33	18.5	39	22	—	—	—	—	—	—	—	—	—
A1165	Gainesville, Fla.	♂ ad. m.	121	110	54	20	6	61.5	26.7	12	35	21	65	35	21	41	22	860	515	345	—	—	67	49	59	55

III.—DIDELPHIS MARSUPIALIS.

Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	Br'dth at canines.	PALATE.			Upper toothrow.	Molar series.	EXTERNAL MEASUREMENTS.				RATIOS.			
					Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at m^4, outside.	Br'dth at m^4, inside.			Total length.	Head and body.	Tail.	Tarsus.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
45740/33705	Hermosilla, Sonora, Mex.......	♀ ad. o.	121	108	51	17	7.6	55	25	10	36	20	65	33	20	35.5	21	912	497	415	76	84	47.2	60.2	51
33135/25735	Monterey, Nuevo Leon, Mex...	♂ ad. m.	116	111.5	51	17	7	59	26	10.5	34	20	62.5	32.5	19	36	20	816	426	390	70	91	45.8	56	53
32951/25558	" " " " ...	♀ ad. m.	103	95	45	20	5.6	50	24	12	32	18	59	31	20	35	19	645	349	296	56	84	47.4	62	52.7
94092	Altamira, Tamaulipas, " ...	♂ ad. o.	116	104	49	17	6	60	24	11.5	34	22.5	63	33.6	—	37	20	802	442	360	70	81	47	60.6	57.7
92963	" " " ...	♂ ad. m.	108	99	47	14	6.5	62	22	11.5	32.5	20	59	31	19	34	20	885	448	437	70	98	46	59.6	52.5
92964	" " " ...	♀ ad. m.	100	94	44	13	5	48	22	12	30	17.8	59.5	30.7	18	37	20.7	756	411	345	66	84	47	63.3	48
95962	" " " ...	♀ ad. o.	108	100	47	15	5	50	27	11	32	20	62	31	18.4	37	21	—	—	—	—	—	47	62	50
90988	San Juan Capistrano, Zacatecas, Mex....................	♂ ad. m.	107.5	96	47.5	14	6	52	22	10	31	18	58	26	16.5	34	19	805	403	402	65	100	49	60.4	54
96820	Culiacan, Sinaloa, Mex........	♂ ad. m.	118	105	53	18	7	59	26	10.5	37	21.5	64	31	18.5	36	19	849	427	412	69	96	50	61	56
91170	Rosario, " "	♀ ad. o.	109	99	48	17	6.4	52	24.5	11	33	20.4	62	31	20	36.5	20	835	433	400	66	94	47.3	62.6	52.5
96821	Mazatlan, " "	♀ ad. m.	105	94	46	14	5	49.6	21	10.5	32	18.5	54	30.4	20	36.5	20	840	435	405	65	93	49	57.4	51.7
96822	" " "	♀ ad. y.	90	83	41.5	11.5	4.5	44	21	11	28	15.3	53	28.5	17	34	19	—	—	—	—	—	50	64	53
98077	Escuinapa, " "	♀ ad. o.	114	102	49	15	6.5	52.6	24	10	35	20	63	31	19	36	19.6	830	460	366	—	80	48	61.7	51.6
96225	Sierra de Choix, Sinaloa, Mex..	♀ ad. y.	91.5	84.4	42	13	6	41.5	20	11	28	15.5	52.5	29	17.5	34	19.5	752	395	357	61	90	50	62.2	49.2
96819	Chacala, Durango, Mex........	♂ ad. m.	117	106	51	19	9	62	26	11	35	22	62	31.5	20	33	19	843	429	414	64	96	48	58.5	58.5
51506	Amecameca, Fed. Dist., Mex...	♂ ad. m.	115	107	51	17	6	60	25	11	38	21	65	31	18.5	37	20.5	850	455	395	76	87	47.3	60.8	56
33832/26419	Pachuca, Hidalgo, Mex........	♂ ad. m.	98	90	44	12.6	6	50	21	10.5	31	16.3	58	31	18	36	20	895	435	370	63	85	49	64.4	55
33833/26420	Real del Monte, Hidalgo, Mex..	♂ ad. m.	92	84	41	12.6	4.5	48	18	11.4	29	17	53	24	18	32	19.4	693	361	332	60	96	49	63	57
52699	Pachuca, Hidalgo, Mex........	♀ ad. m.	102	92.5	47	14	5	46.5	20	10	31.5	17	57	29	17.5	35	20	—	—	—	—	—	50	62	50
51865	" " "	♀ ad. m.	96	90	44	14	5	47.5	20	10.7	30	16	55	28.5	17	36	20	—	—	—	—	—	49	61	52.7
92978	Metlaltoyuca, Puebla, Mex.....	♂ ad. o.	124	111	54	17	6.5	60	27	11	36	22	68	33	21	40	21	855	460	395	73	86	48.7	61.3	54
55579	San Martin, " "	♀ ad. m.	105	92.5	45	14.5	5	50	23	12	32	18	61	30.7	20	37.3	20	773	441	332	64	75	48.7	66	54
65954	Tuxtepec, Oaxaca, Mex........	♂ ad. m.	123	115	52	17.3	7	64	26	11	37	25	70	36	20	39	20	802	435	367	66	82	45.2	60.8	54
65955	" " "	♀ ad. o.	120	111	53	16.5	6	58	26	13	36	20	68	34	20	41	21	850	465	385	70	83	47.7	61.3	52
65542	" " "	♀ ad. m.	112	105	51	14	6.5	53.5	21	11.5	34	19.5	65	34	20	40.5	21	—	—	—	—	—	—	62	—
73490	Tehuantepec " "	♂ ad. m.	131	118	56	18.5	7	67	30	12	41	23	71	33.5	21	40	22[1]	930	484	446	80	92	47.5	60	—
73708	San Mateo del Mar, Oaxaca, Mex.........................	♂ ad. m.	113	96.5	42	16	6.5	59	24	9.6	33.6	20	58	32	19	35	20.5	—	—	—	—	—	—	—	—
73491	Guichecovi, Oaxaca, Mex......	♀ ad. m.	113	106	52	16	6	56.5	25.3	12	34.3	19.5	66	34	21	39	21	853	483	370	70	76.5	49	62	50
73492	" " "	♂ ad.	106	96	42.5	16	6	56	23	12	32	21	60	31	19	39	22	755	370	385	69	104	44.3	62.4	53
69798	Cuicatlan " "	♀ ad. m.	102	95	45.5	16	6	51	25	11.5	30.5	18.6	60	30.3	18.5	35	19.5	805	393	412	69	105	48	64.2	54
69799	" " "	♂ ad. m.	118	109	52	18	7.5	65	28.6	11	38	24	64	32.6	20	37	21	—	—	—	—	—	47.7	59	60

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[1] *Five* molars.

III.—DIDELPHIS MARSUPIALIS (continued).

Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	Br'dth at canines.	PALATE.			Upper toothrow.	Molar series.	EXTERNAL MEASUREMENTS.				RATIOS.			
					Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at m $\frac{4}{}$, outside.	Br'dth at m $\frac{4}{}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
45300	Armeria, Colima, Mex.	♂ ad. o.	127	114	52	20	8	67.5	30	12	38.5	26	67	34	21	37	20	—	—	—	—	—	45.6	59	59.2
45274/33269	“ “ “	♂ ad. o.	117	109	45	18	6	61	26.6	10	31	22.5	64	31	19	37	20	855	439	416	79	95	41.3	59	56.5
45273/33268	“ “ “	♂ ad. o.	117	108	48.5	16.5	7	58	24	10.5	35	22	67	32.5	20	39	21	882	463	419	71	90.5	45	66.7	53.7
45271/33266	“ “ “	♀ ad. o.	111	100	48.5	16.2	6	53	24	11	34.5	20	62	30.5	19	35.5	19.5	870	448	432	67	96	48.5	62	53
45270	“ “ “	♂ ad. m.	109	101	50	14	5.3	55	24	11	33.5	20	61	30	18	20	20	—	—	—	—	—	49.5	60.4	54.4
45294	“ “ “	♂ ad. o.	112	101.6	48	18	7.5	58.5	26	10.5	34	20	63	31.3	19	36	—	—	—	—	—	—	47	62	57.6
45296	“ “ “	♂ ad. m.	106	96	48	16	6	53	24	10.3	34	19	59	30	17.4	37	20	—	—	—	—	—	47.2	61.4	55.2
45298	“ “ “	♂ ad. y.	105	95	46.5	15.5	6	57.3	25	11	32.3	19	58.5	31	18	36	21	—	—	—	—	—	49	61	60.3
45297	“ “ “	♂ ad. m.	105	95	46	15	5.7	54	22	11	31	18	58	32	18	36	20.3	—	—	—	—	—	48.8	61.6	56.8
45295	“ “ “	♂ ad. y.	102	94	45.6	15	6	51.3	22	10	31.3	17	57	30	17	35.4	20.5	—	—	—	—	—	48.5	60.6	54.6
45293	“ “ “	♂ ad. m.	100	91.5	41.6	13.5	5.8	46	21.6	12	30	16.5	58	31	17	38	21.3	—	—	—	—	—	45.7	63.4	50.3
44560/32637	Manzanillo “ “	♂ ad. o.	125	111	58.7	15	8	63	27	10	36	22	66	30	19	36.5	20	932	487	445	73	91	52.9	59.5	56.8
44559/32646	“ “ “	♂ ad. o.	122.5	108.5	53	17.6	7.6	65.5	27	10.5	38	24	66	33.5	19	36	20.2	690	425	365	56	87	48.8	60.8	60.4
45231/33226	“ “ “	♂ ad. m.	117	—	43	14	6	52.5	22	11	32	19	60	30.6	18	36	20	780	405	375	62	92	—	—	—
44568/32645	“ “ “	♂ ad. y.	100	91	44	16	6	53	22	12	32	18	56	33.5	—	33.6	19.7	792	412	380	67	92	48.3	61.5	58
44562/32639	“ “ “	♀ ad. o.	107	97	44	16.5	7	59.3	23	11.4	32	19.5	59	31	19.6	35.5	19	812	414	398	62	93	45.3	60.8	61
46429/34338	Atemajac, Jalisco, Mex.	♀ ad. o.	117	109	52	19	6.5	61	25	10	36	21.5	63.5	30	19	35	20	872	474	398	72	84	47.7	58.3	64
46430/34339	“ “ “	♂ ad. y.	110	92	46	15	5.5	55	23	11	32	19	57	31.5	19	35	20	728	367	361	66	98	50	62	60
45562/33517	Zapotlan, “ “	♀ ad. o.	96	88.5	41	18.5	5	50	22	11	30	17	55	31	20	35	19	755	383	372	62	97	46.3	62.2	56.5
88142	San Sebastian, “ “	♀ ad. m.	93	85	40	18.5	5	47	21	11.5	30	15	55	30	17.5	34	19	718	348	370	60	106	47	64.7	55.3
A16625	Guadalajara, “ “	♀ ad. m.	92.5	89	41	14	5	47.3	21.5	11.3	29	16	56	29	19	36	20	—	—	—	—	—	46	64	53
A16626	“ “ “	♀ ad. m.	96	90	41	16	5.3	50.5	21	11.3	30	18	56	30.5	19	35	19.7	—	—	—	—	—	45.5	62.2	56
A16627	“ “ “	♀ ad. o.	98	91	39.5	14.3	6	48.7	21	11	31.3	17	57	30	18	35	20.6	—	—	—	—	—	44	62.6	53.5
A16628	“ “ “	♀ ad. m.	100	93	41	15	6	48	21	11.6	31	16.5	52	30	18	35	20	—	—	—	—	—	44.2	56	51.6
A16629	“ “ “	♀ ad. m.	95	89	42	14.5	6.5	50	22	10.5	30	18	54	29.5	18	33.5	19	—	—	—	—	—	47.2	60.7	56
A16630	“ “ “	♀ ad. o.	97	88.5	40	15	6	51	22	11	31	16.5	56	31	18	34	19.5	—	—	—	—	—	45.2	64.4	57.6
47812/35528	Querendaro, Michoacan, Mex.	♂ ad. m.	115	105	48	15	7.3	53	24	11	34	20.3	64	32	20	37	20.7	850	449	401	67	87	45.7	61	50.5
47811/35527	“ “ “	♀ ad. m.	102	93	45	16	5.5	52	22.5	11.2	33	17	57	31	18.5	36	20	750	385	365	63	94	48.4	61.3	56
47810/35526	“ “ “	♀ ad. o.	104	94	45	16	6	52	23	12	33	20	60	30	19	36	20	755	413	342	65	83	48.5	63.8	50
70617	Acapulco, Guerrero, Mex.	♂ ad. o.	122	110	54	20	8	62	30	12	36.5	24	66	31	20	37.5	20	910	508	402	73	80	49	60	56.4
70619	“ “ “	♂ ad. y.	110	95	46	16	6	51	23	11	31	18.5	60	31	19	37	20.4	804	435	369	66	85	48.4	63	53.7
70620	“ “ “	♀ ad. o.	105.5	96	47	16	6	50	23	11	32	19	62	30.5	18.5	36.3	20.3	839	439	400	64	84	49	64.6	52
70618	“ “ “	♀ ad. m.	108	100	46.5	16.3	7	51	24.6	10.7	32	18	60	30.5	19.3	35	20	835	455	380	65	84	46.5	60	51
58415	Orizaba, Vera Cruz, Mex.	♂ ad. o.	130	114	56	20	8.5	67	25	10.4	38.7	24	68	34	23	37	19	845	387	458	70	82	49	60	59.6
58165	“ “ “	♀ ad. m.	111	97.5	46	15	6.3	52	23	10	33.5	23	59	31.6	20	37	20.5	—	—	—	—	—	47	61.5	53
58162	“ “ “	♂ ad. y.	107	98	47	16.4	6	53.5	25	10.3	34.6	20	61	33	20	37.5	21	—	—	—	—	—	48	64.5	57.5
58416	“ “ “	♀ ad. m.	110	99	48	16	7	56	22	12	33	20.3	61	34	21	37	20	830	338	492	67	69	48.4	69	57
54989	Jico, “ “	♂ ad. o.	136	128	58	19	8	69	28	10.5	42	28	76	34.5	22	39	20.5	940	405	535	78	76	45.3	60	54
78123	Minititlan, “ “	♂ ad. o.	122	113	52	16	7	62	25	11.3	35	22	69	—	—	37	21	889	364	515	78	70	46	67.5	60.8

IV.—D. MARSUPIALIS TEXENSIS.

	Mus. No.	Locality.	Sex and age.	Total length.	Basal length.	Nasals.			Zyg. breadth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	Br'dth at canines.	Palate.			Upper toothrow.	Molar series.	External Measurements.				Ratios.			
						Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at m $\frac{4}{4}$, outside.	Br'dth at m $\frac{4}{4}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
Didelphis m. texensis	$\frac{45137}{33133}$	Brownsville, Tex.	♂ ad. m.	121	110	52	18.5	6	57	27	11.4	36.5	21	64	32	20.5	37	20	820	410	410	70	100	46	58	51.8
	$\frac{41871}{29791}$	" "	♂ ad. y.	111	100	52	16	6.7	59	25	11.6	35.3	20	60	30	18.5	35	19.3	810	460	350	68	80	52	60	59
	$\frac{45136}{33132}$	" "	♂ ad. y.	95	87	41.5	15	5	46	27.7	10	29	17.3	53	30	19	35	20	700	380	320	60	84	48	60.9	53
	$\frac{44614}{32691}$	" "	♀ ad. y.	99	89	43	14.7	6	46	21	10	28.3	16	56	29	18	35	20	800	400	400	60	100	48	63	51.7
	$\frac{45135}{33131}$	Matagorda, "	♀ ad. y.	96	90	42	15	5	47	23.4	11.3	30.5	17.5	54	30	18	33.5	20.6	710	360	350	60	97	46.6	60	52.2
	$\frac{44267}{32431}$	" "	♀ ad. m.	116	107	50	19	7	60.5	28	12	35	20	66	36	21	38	21.6	820	505	315	66	62	46.7	61.7	56.5
	44235	" "	♂ ad. o.	120	109	54	20	6	70	27	12	34.5	23.5	65	35	21	37	20.6	—	—	—	—	—	49.5	59.6	64.2
	99708	Port Lavaca "	♂ ad. m.	128	117.5	57	21	6.5	68.3	27.6	11	38	24	70.5	35.5	20.5	40.5	23	—	—	—	—	—	48.5	60	58
	$\frac{31765}{24359}$	Sycamore Creek, Tex.	♂ ad. y.	112	103	57	17	6	52	26.7	11.3	31.5	19	62	31	19	38	20.6	730	370	360	71	97	55	60.1	50.4
	25223	Del Rio, Val Verde Co., Tex.	♂ ad. m.	108	96	48	17	6	54	24.5	11	32	20	58	32	20	36	20	—	—	—	—	—	50	60.4	56.2
	99908	Corpus Christi, Tex.	♂ ad. m.	110	98	48	16	6.5	58	26	10	33	20	59	33	—	36	20	800	430	370	64	85	49	60.2	60
	$\frac{43280}{31415}$	" " "	♂ ad. m.	109	95	50	16	7	54	25.3	10.5	34	20	59	31	19	36	19	800	430	370	64	86	52.6	62	56.8
	43805	" " "	♀ ad. m.	104	97	50	17	7	54	23	12.5	31	19	59	32.6	19.5	36	20.5	730	475	255	65	56	51.5	60.8	55.6
	$\frac{43770}{31909}$	" " "	♂ ad. y.	111	98	49	17	6	56	26	11	33	21	61.7	32.5	20	36.5	21	820	460	360	73	80	50	63	57
	A $\frac{5878}{7274}$	Rockport, Tex.	♀ ad. o.	103	92	45	16	7	50	23	12	29.5	18	58	30.5	19	33.5	20	698	418	280	58	69	49	63	54

V.—DIDELPHIS MARSUPIALIS TABASCENSIS AND D. RICHMONDI.

	Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	Br'dth at canines.	PALATE.			Upper toothrow.	Molar series.	EXTERNAL MEASUREMENTS.				RATIOS.			
						Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at $m\frac{4}{4}$, outside.	Br'dth at $m\frac{4}{4}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
D. marsupialis tabascensis.	100510	Teapa, Tabasco, Mex........	♂ ad. o.	122	111	58	17	6.3	62.5	25	12	35	25	66	32.5	21	37	20	919	456	463	71.5	102	52.3	60	56.3
	100511	" " "	♂ ad. m.	119	108	55	15	6	61	23	11.5	33	21.5	65	31	20	36.5	20	914	465	449	69.5	97	51	60.2	56.5
	100512	" " "	♂ ad. m.	115	105	53.5	15.5	7	60	24	11.3	34.3	20.5	64	32	19	37	20	902	460	442	69	96	51	61	57
	100509	" " "	♀ ad. m.	108	99.5	49	16	6.2	54	26	12	31.5	19	61	33.4	20	37	20	783	398	385	65	97	50	61.2	54.3
	100513	" " "	♀ ad. o.	103	94	49	13	6	47	20	11	29	16.5	60	29	—	36	—	835	421	414	62.5	98	52	61.7	50
	100507	Frontera, " "	♂ ad. m.	116	103	55	15	6	57	23	10	33	15	61	29	17.5	35.6	19.3	846	429	417	66.5	97	53.4	59.2	55.3
	100508	" " "	♀ ad. y.	96.5	88	43.6	13.6	5.7	48	20	11.3	29	17	55	30	19	36	20	763	362	401	61	110	49	60.2	54.5
	58687	Mirador, Vera Cruz, Mex....	♂ ad. m.	108	98	53	15	6	58	24	11.5	32	20	61	31	20	36.5	20	870	420	450	70	107	54	62.3	59
	58688	" " "	♀ ad. m.	101	94	48	16	6	57	26	12	31	18.3	59	29	19	36	20	823	388	435	63	112	51	62.7	60.6
	56890	" " "	♂ ad. y.	104	92	50	13	5.5	49	23	12	31	18	59	31	19	38	20.6	825	410	415	65	104	—	—	—
	65543	Catemaco, " "	♀ ad. y.	109	100	53	15	5	50	26	12	32	18	62	32	—	39	20	—	—	—	—	—	53	62	50
	65957	" " "	♀ ad. y.	105	96	50	19	5.7	48	23	12	31.5	18	60	30	20	37	20	886	455	431	64	95	52	62.5	50
	65956	" " "	♂ ad. o.	121	109	55	18	6	58	25	10	34	22	66	32	21	40	—	856	488	368	72	75	50.5	60.6	53
	93044	Papantla, " "	♀ ad. m.	101	92	46	15	6	49	22.5	11.5	29	17.5	59	29	17.5	35	19	811	415	396	60	95	50	64	53.3
	93043	" " "	♂ ad. y.	90	82	45	11.5	5	45	18.3	10.5	26	15.6	53	27	16	33	18.4	684	349	335	57	96	54.9	59	54.9
	76207	Tuxtla, Chiapas, Mex........	♀ ad. m.	91.6	87.8	46	14.6	5	47	21	12	28.3	16.5	56.5	30	19.5	36	20	783	417	366	59	86.5	52	64.3	51.3
	76214	Tumbala, Chiapas, Mex.....	♂ ad. y.	122	101	55	16.5	6.3	59	26	12	36	22	66	34	21	37.5	21	830	448	382	68	88	55	65	58.4
	76211	" " "	♂ ad. o.	139	125	59	22	8	68	32	11.3	42	25	76.5	34	21	41	22	930	494	436	75	88	47	61	54.5
	76213	" " "	♀ ad. o.	114	104	52	15	6	56	22	13.3	34.6	20	63	34	21.5	35	20	794	444	350	68	80	50	61	53.8
	76212	" " "	♀ ad. m.	98.3	91	43.5	14	4.5	50	24	12	31.5	17	58	31	18	35	20	—	—	—	—	—	—	—	—
	76209	San Christobal, Chiapas, Mex	♀ ad. m.	99.5	91	45	13	5	50	21	12	29	18	58	32	19	36	20	725	407	318	58	79	50	63.7	50.5
	76202	Ocozocuantla, " "	♀ ad. m.	99	91	45	14.5	4.7	50	23.7	12	31.5	17.3	58.3	30.3	18.6	35	20	780	418	362	67	87	50	64	55
	76203	Ocuilapa, " "	♂ ad. m.	116.5	105	54	17	6.8	58	28	11	34	20.5	66	31	20	38	20	845	501	344	73	68	51.7	63	55
	77688	Huehuetan, " "	♂ ad. o.	134.5	122.5	63	19	7.5	68	27	12.5	41.7	24.7	74.5	34.5	--	44	25[1]	1017	581	436	—	74	51.3	60.8	55.5
	77687	" " "	♀? ad. m.	120	111	51	16	7	53.3	25	11.8	33.3	20	61	30.7	19.3	38	20.6	—	—	—	—	—	—	—	—
	77997	" " "	♀? ad. o.	122	109.5	60	16.5	6	57	25.5	11.7	34.5	21	67	33	21	40	22.5	—	—	—	—	—	54.8	61.5	52
D. richmondi.	45140 33136	Greytown, Nicaragua........	♀ ad. m.	114	104	54	15	7	55	25	11.5	32.5	20	65	31	19	37.4	15	948	471	477	70	100	52	62.5	52.6
	33134 45138	" "	♀ ad. o.	106	96	52	17	6.5	52	22	11	30.3	18	62	30	19	38	15	874	394	480	65	122	54.2	64.6	54
	33137 45141	" "	♀ ad. y.	102.5	92	50	13.3	5	47	23	11	28	17	60.5	30.7	19	38.6	16.7	853	400	453	65.5	113	54.3	64.7	51

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[1] *Five* molars.

VI.—DIDELPHIS KARKINOPHAGA, D. K. COLOMBICA, D. K. CAUCÆ, AND D. PERNIGRA.

	Mus. No.	LOCALITY.	Sex and age.	Total length.	Basal length.	NASALS.			Zyg. br'dth.	Postorb. br'dth.	Postorb. constr.	Occip. br'dth.	Br'dth at canines.	PALATE.			Upper toothrow.	Molar series.	EXTERNAL MEASUREMENTS.				RATIOS.			
						Length.	Gr. br'dth.	Least br'dth.						Length.	Br'dth at m $\frac{4}{4}$, outside.	Br'dth at m $\frac{4}{4}$, inside.			Total length.	Head and body.	Tail.	Tarsus.	Tail to head and body.	Nasals to basal length.	Palate to basal length.	Zyg. br'dth to basal length.
D. karkinophaga.	A$\frac{6124}{7740}$	Island of Trinidad........	♂ ad.	110	100	49	14.5	5.5	61	22	10	32	20	61	28	17	36	20	920	455	465	66	102	49	61	61
	A$\frac{6119}{7734}$	" " "	♂ ad.	110	101	50	16	5.5	63.5	24	11	32	20	61	30	—	34.5	19.5	910	470	440	57	91	49.5	61	62.8
	A$\frac{6116}{7731}$	" " "	♂ ad.	101	91	47	13	6	—	21	11	30	19	56	31.5	20.5	33	19	955	500	455	57	90	51.7	61.5	—
	A$\frac{6117}{7732}$	" " "	♀ ad.	109	101	51	18	6	55	23	11	34	18	63	34.5	21.5	39	20	830	400	430	57	107	50.5	62.4	54.5
	A$\frac{4782}{6062}$	" " "	♀ ad.	111	100	46	15	6	59	24	10.7	33	20	60	30	20	34	19.5	740	350	390	55	112	46	60	59
	A$\frac{6118}{7733}$	" " "	♀ ad.	100	90	48	13	5.6	50	23	11	28	17	57	30	18	35	20	850	468	382	58	100	53	63.3	55.5
D. k. colombica.	A14613	Santa Marta, Colombia.....	♂ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	710	355	355	57	100	—	—	—
	A15456	" " "	♂ ad.	118	109	55	17	7	60.5	20	10.5	35	22	66	30	20	37	20	980	497	483	68	97.2	50.5	60.6	55.5
	A15452	" " "	♀ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	812	406	406	57	100	—	—	—
	A15454	" " "	♂ ad.	104	—	48	20	6	—	23	11	—	20	58	31	20	37	20.5	—	—	—	—	—	—	—	—
	A14615	" " "	♂ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	786	456	330	57	75	—	—	—
	A15452	" " "	♂ ad.	95	—	45	13	6	54.5	20	11.5	28	19	55	28.5	18	32	18	824	371	453	57	123	—	—	—
	A15456	" " "	♀ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	980	497	483	68	97.2	—	—	—
	A14614	" " "	♀ ad.	96	89	45	14	6.5	48.5	25	11	28.5	17	55	29	18	33	19	863	406	457	54	113	50.5	62	54.4
	A15455	" " "	♀ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	673	318	355	57	111	—	—	—
	A15451	" " "	♀ ad.	97	88	44	13	5	51	21	11	29	18	55	29	18	34	19	—	—	—	—	—	50	62.5	58
D. k. caucæ.	A14206	Cali, Colombia............	♂ ad.	107	99	50	16	6.4	57	21	10	31	21	60	29	18	36	20	—	—	—	—	—	50.5	59.9	57.5
	A14196	" "	♂ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	770	410	360	53	87.8	—	—	—
	A14199	" "	♂ ad.	94	—	42	15	6	52.7	21	11.5	29.3	20	55	31	19	34	19.5	—	—	—	—	—	—	—	—
	A14198	" "	♂ ad.	96	87	44	15	5.3	48.5	21	12	28	16	56.5	30	18	36	19	—	—	—	—	—	50	65	55.7
	A14201	" "	♂ ad.	94	85	44	14.5	5	50	19	11	28	18	54.5	28	17	34	19	740	370	370	48	100	51.7	64	58.8
	A14192	" "	♀ ad.	93	88	46	14	5.8	50	20	11	23	17.5	55	30	19	35	18.5	—	—	—	—	—	52.3	62.5	57
	A14202	" "	♀ ad.	107	97	50	18	5.5	56.5	25	11.7	30	19	61	31	21.5	35	20	740	370	370	58	100	51.6	62.9	58
D. pernigra.	A16470	Inca Mines, Peru..........	♂ ad. y.	81	74	38.5	13	5.5	40.5	20	11	25	15	—	—	—	—	—	698	336	362	57	100	52	—	54.7
	A16467	" "	♂ ad.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	635	305	330	57	108	—	—	—
	A16471	" "	♂ ad.	80	74	39	12	5.5	40	20	11	25	14.8	47	27	—	29.5	16	660	317	343	57	108	52.7	63.5	54
	A16071	" "	♀ ad.	87.3	81	43	13.5	5.4	42	21	11	28	15.6	53	26.3	18	32	17	749	381	368	63	99.5	53	65.4	51.8
	A15798	" "	♀ ad.	84	78	42.5	12	5	—	20	11.3	26	15	51	25.3	16	31.5	17	711	443	368	60	82	53.2	65.4	—
	A16469	" "	♀ ad.	85	78	42	14	6	43	22	11	27	14.5	51	26	16	31	17	737	343	394	57	112	53.8	65.4	55
	A16468	" "	♀ y.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	660	300	360	57	120	—	—	—

EXPLANATION OF THE PLATES.

PLATE XXII.

VARIATION DUE TO AGE IN DIDELPHIS VIRGINIANA.

Figures all $\frac{1}{2}$ nat. size.

Fig. 1.—No. 48598, U. S. Nat. Mus., ♀, Cedar Vale, Kan. Side view.

Fig. 1*a.*—Same specimen from side.

Fig. 1*b.*—Same specimen, from below. Milk premolar and m^{1} in place.

Fig. 2.—No. 47498, U. S. Nat. Mus., ♀, Cedar Vale, Kan. Side view.

Fig. 2*a.*—Same specimen, from below. Milk premolar and m^{1} and m^{2} in place.

Fig. 3.—No. 49364, U. S. Nat. Mus., ♂, Brazos, Texas. Side view.

Fig. 3*a.*—Same specimen, from below. The milk premolar has been shed and p^{4} is just appearing; m^{1-3} in place, the latter about half grown.

Fig. 4.—No. 79117, U. S. Nat. Mus., ♂, Sebastian, Florida. From side.

Fig. 4*a.*—Same specimen from below. Permanent p^{4} and m^{3} nearly full grown; m^{4} not yet developed.

Fig. 5.—No. 45401, U. S. Nat. Mus., ♂, Bay St. Louis, Miss. From side.

Fig. 5*a.*—Same specimen from side. Fully adult, but teeth very little worn.

This specimen is of further interest on account of the double canine on the left side.

PLATE XXIII.

DIDELPHIS MARSUPIALIS, D. M. TABASCENSIS, AND D. VIRGINIANA.

All figures $\frac{1}{2}$ nat. size, except figs. 6 and 7, which are natural size.

Fig. 1.—*Didelphis marsupialis tabascensis*, ♀ ad., No. 100509, U. S. Nat. Mus., Teapa, Tabasco, Mexico.

Fig. 2.—*Didelphis marsupialis tabascensis*, ♂ ad., No. 100513, U. S. Nat. Mus., Teapa, Tabasco, Mexico. Figures 1 and 2 illustrate individual variation in the form of the posterior border of the nasals.

Fig. 3.—*Didelphis marsupialis*, ♂ ad., No. 45274, Colima, Colima, Mexico, showing the usual or normal form of the nasals in *D. marsupialis*, for comparison with Fig. 2, which illustrates the normal form of the nasals in *D. m. tabascensis*, and Fig. 4, which shows the normal form of the nasals in *D. virginiana.*

Fig. 4.—*Didelphis virginiana*, ♂ ad., No. 316, Miller's Place, Long Island, N. Y., illustrating a normal old male skull, for comparison with the other forms of the genus.

Fig. 5.—*Didelphis marsupialis*, ♂ ad., No. 73492, U. S. Nat. Mus., Tehuantepec, Oaxaca, Mexico. To show the pair of supernumerary molars (m^{5}).

Fig. 6.—*Didelphis marsupialis tabascensis*, ♂ ad., No. 77688, U. S. Nat. Mus., Huehuetan, Chiapas, Mexico. To show supernumerary m^{5} on left side.

PLATE XXIV.

DIDELPHIS PERNIGRA, D. MARSUPIALIS TABASCENSIS, AND D. RICHMONDI.

All figures ½ nat. size.

Figs. 1–1*a*.—*Didelphis pernigra*, ♀ ad., No. 16071, Am. Mus., Inca Mines, Peru. Type of the species.

Figs. 2–2*a*.—*Didelphis marsupialis tabascensis*, ♀ ad., No. 5 8687, U. S. Nat. Mus., Mirador, Vera Cruz.

Figs. 3–3*a*.—*Didelphis richmondi*, ♀ ad., No. 45140, U. S. Nat. Mus., Greytown, Nicaragua.

PLATE XXV.

YOUNG OF DIDELPHIS VIRGINIANA AND D. MARSUPIALIS, TWO STAGES.

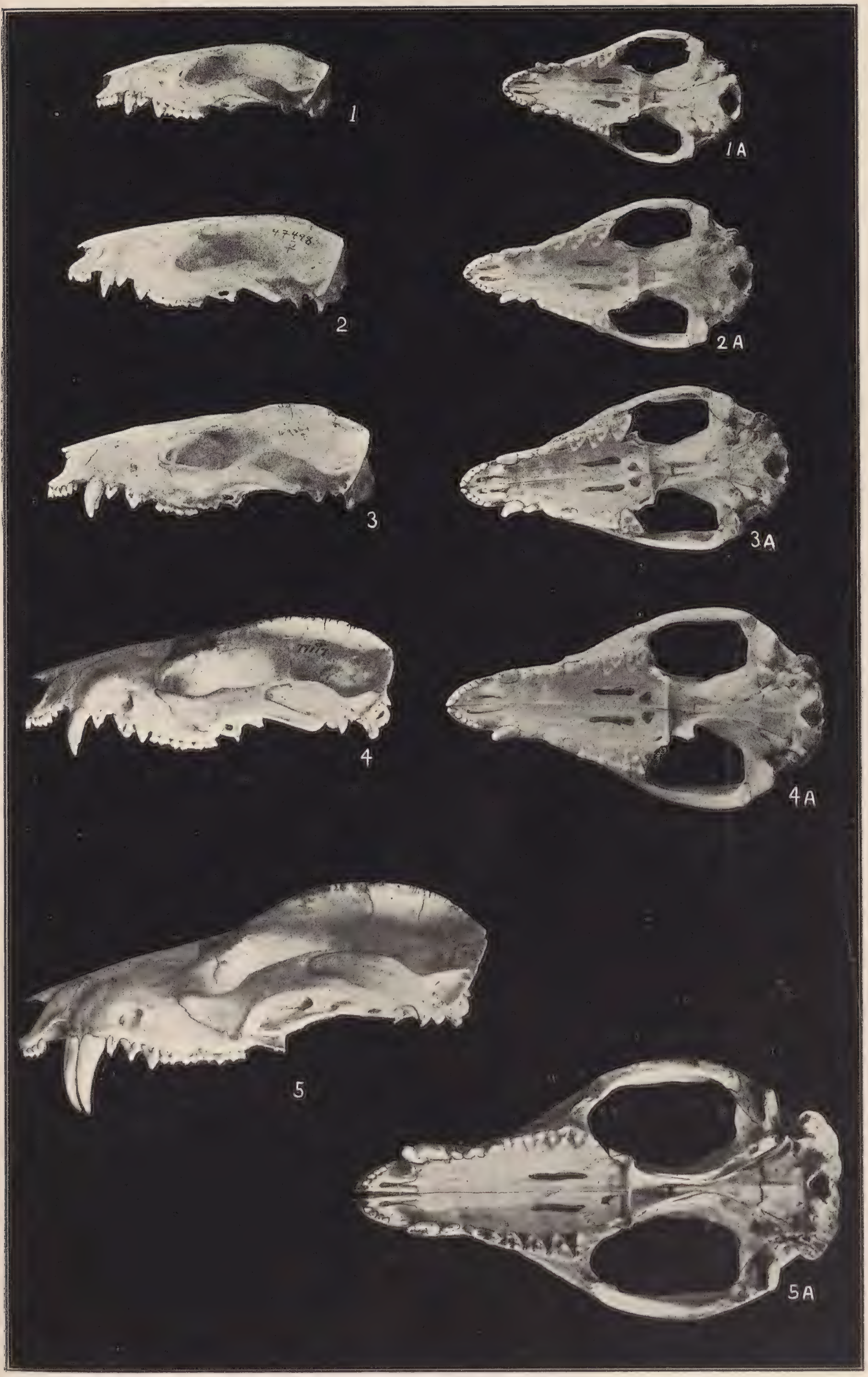
Figures ½ nat. size.

Fig. 1.—*Didelphis marsupialis*, very young. No. 34502, U. S. Nat. Mus., Etzaplan, Jalisco, Mex. Comparable with Fig. 3, *D. virginiana.*

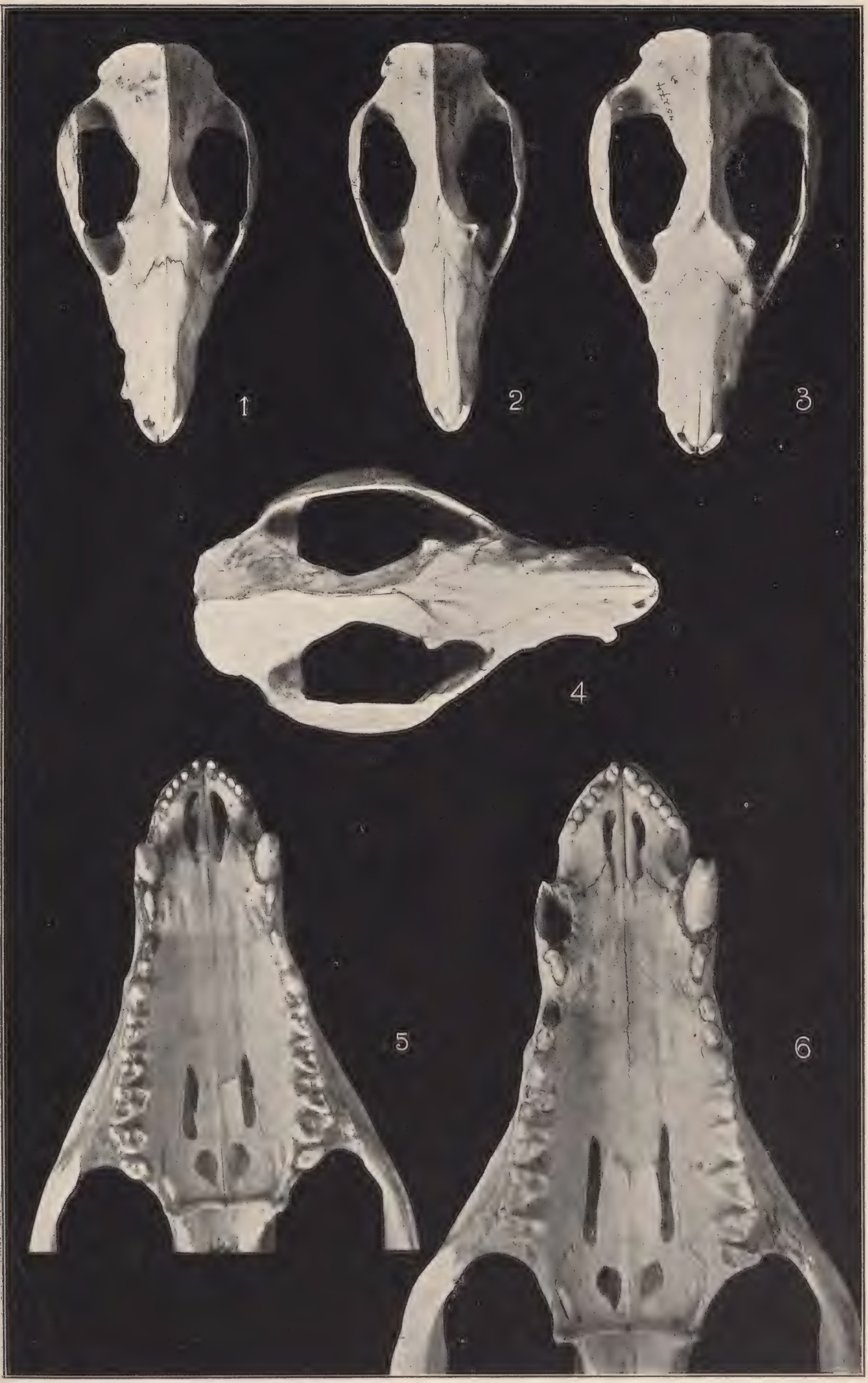
Fig. 2.—*Didelphis marsupialis*, somewhat older than the specimen illustrated in Fig. 1, and comparable with Fig. 4. No. 34560, U. S. Nat. Mus., Tulancingo, Hidalgo, Mex.

Fig. 3.—*Didelphis virginiana*, very young, corresponding in age to the specimen illustrated in Fig. 1. No. 36142, U. S. Nat. Mus., Hartshorne, Ind. Ter.

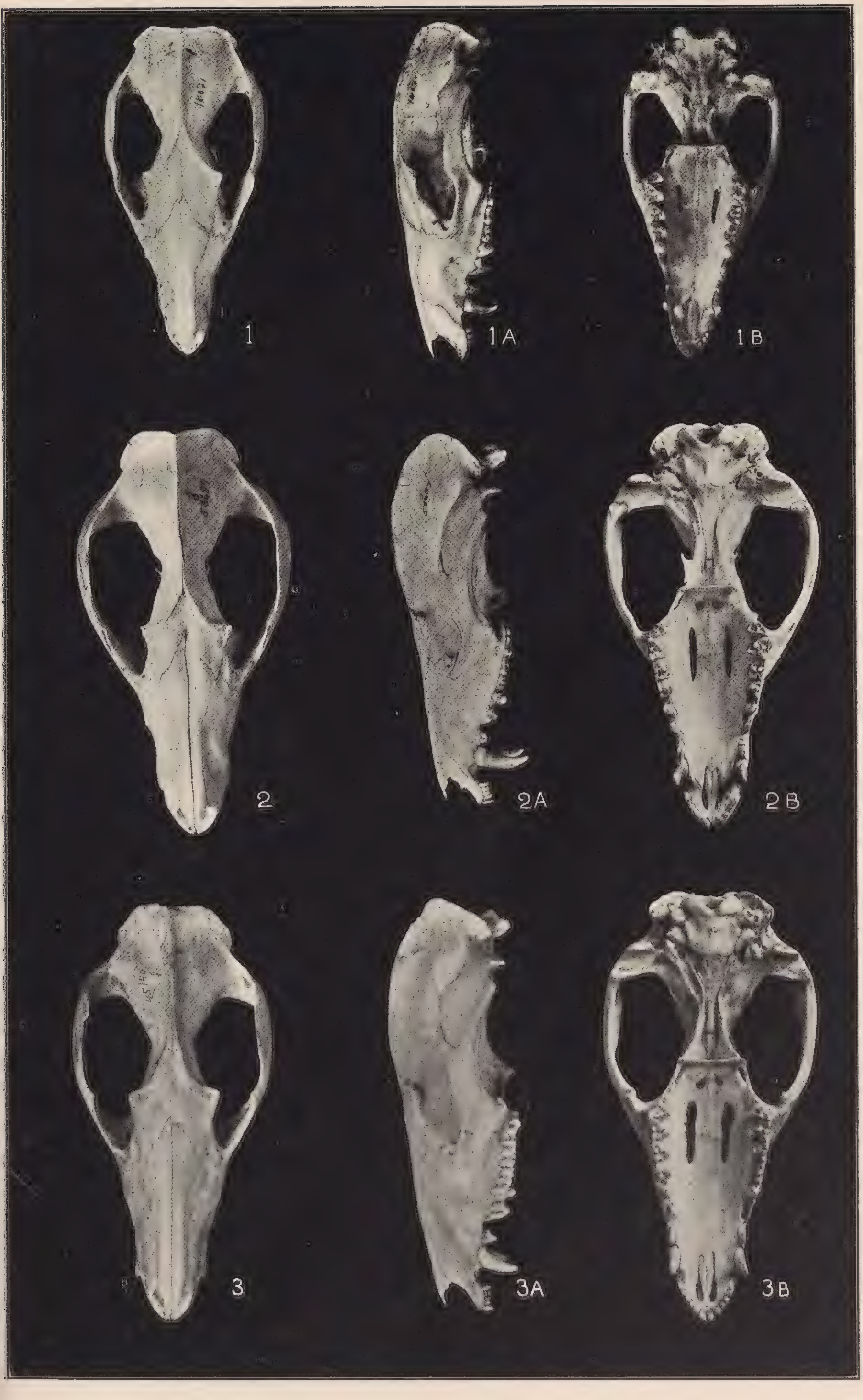
Fig. 4.—*Didelphis virginiana*, somewhat older than the specimen shown in Fig. 3, and comparable with Fig. 2. No. 34560, U. S. Nat. Mus., Marble Cave, Mo.



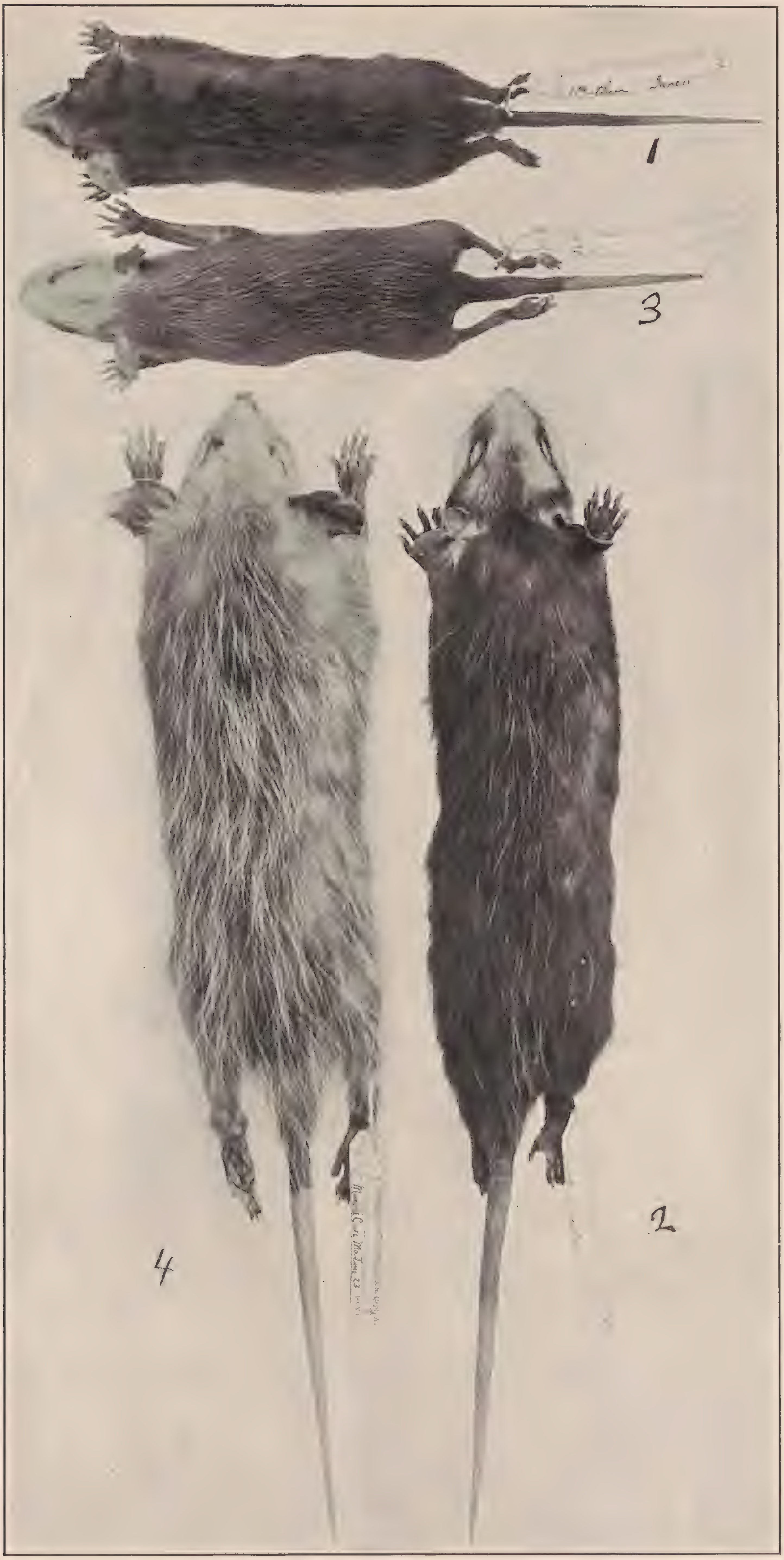
Stages of Growth in Didelphis virginiana.



1, 2, 6, Didelphis marsupialis tabascensis; 3 and 5, D. marsupialis; 4, D. virginiana.
Figs. 5 and 6 show supernumerary molars.



1–1*a*, Didelphis pernigra ; 2–2*a*, D. marsupialis tabascensis ; 3–3*a*, D. richmondi.



1 and 2, Didelphis marsupialis; 3 and 4 D. virginiana.

Article XII.—ON JURASSIC STRATIGRAPHY IN SOUTHEASTERN WYOMING.

By F. B. Loomis.

Plates XXVI and XXVII.

The purpose of this paper is to give some details in regard to the Jurassic strata of Wyoming, in which, for the last four years, the American Museum of Natural History has collected Dinosaur remains. Very little detail geological work has been done in the region. Prof. W. C. Knight published a map of southeastern Wyoming showing the Jurassic exposures[1]; and this is in part reproduced, with his consent, in Plate XXVI, Fig. 1, to show the location of the area in which the succeeding maps and sections are located. Prof. W. N. Logan[2] has also published a section made in the Freezeout Hills. The area studied, lying along the county line between Albany and Carbon Counties, includes all of the quarries worked for the American Museum; and, incidentally, a considerable number of Marsh's localities, where they were within the area mapped, are indicated.

Referring to Plate XXVI, Fig. 1, the axis of the Laramie Mountains is seen in the eastern part of Albany County, extending nearly north and south; but in Converse County it bends until it extends nearly west. In the angle thus formed are situated four short (8–20 miles in length), sharp folds, known as the Medicine, Como, Prager, and Miser anticlines. Their axes lie northeast and southwest, and each fold is thrust over beyond the vertical on its northern side. These folds are radial folds formed at the edge of the territory affected when the Freezeout Hills were thrown up. While the Laramie Mountains seem to be due to a thrust from the east, there must have been a force acting from the north in the neighborhood of the Freezeout Hills. This thrust from the north seems to have affected locally the axis of the Laramie Mountains, bending it to an east and west direction. The four short anticlines above named die out on the eastern boundary of the territory affected by the thrust from the north. How far west this thrust from the north, to which the Freezeout Hills are due, acted I cannot say.

It is along the southern exposures of Medicine and Como anticlines that the American Museum parties have worked, where the dip is 14–18°. The north sides of these folds stand too nearly vertical to be worked. Plate XXVI, Fig. 3, shows a section reconstructed to show the appearance of these folds had no erosion taken place. The position of this section is shown on Plate XXVI, Fig. 2, by a line from H to L running N. 25° W. The line starts on the Little Medicine River, about one and one half miles below the mouth of Sheep Creek. For ten rods on either side of the river all rocks are covered by river deposits. At the locality *c*, a collection of fossils[1] showed the presence of the Cretaceous (Fort Pierre); while within three rods to the south undoubted basal beds of the Jurassic[2] are found. A fault is thus indicated. While in the field I did not trace it out, so cannot speak in regard to its extent. The Jurassic is here inverted so that its basal member is uppermost. Between the Jurassic and the typical Triassic occurs a bed of creamy white sandstone, 40 feet thick, the same as is found in the Freezeout Hills, but this sandstone is lacking on the exposures situated further south. The Jurassic dips 60° S. (strike N. 53° E.), but proceeding south the dip quickly becomes vertical, changes to the north, and gradually diminishes till in the midst of the Triassic it becomes horizontal. The strata soon dip to the south increasing to about 14°, at which angle most of the rocks, as far as the Fort Pierre bed, dip.

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[1] Bull. Geol. Soc. America, Vol. XI, p. 377, 1900.
[2] Kan. Univ. Quart., Vol. IX, p. 109, 1900.

At G the section changes its course to N. 5° W., crossing the Jurassic of the south side of the Medicine anticline. The Jurassic beds are here 274 feet in thickness and are overlaid by the coarse sandstones of the Dakota to the extent of 275 feet. Above these in turn lie the Fort Benton shales, the lower 80 feet of which consist of dense sandy limestone; while the upper 320 feet are thin bedded argillaceous shales, characterized by abundance of teleost fish scales. Above the Fort Benton are about 800 feet of slate-colored clay in which the stratification is obscure. On account of their soft texture these clays are easily eroded and the exposure is usually occupied by a long 'draw.' On weathering the clay turns black. As this clay overlies the Fort Benton and underlies the Fort Pierre, I consider it the representative of the Niobrara, although it is non-fossiliferous. A bed of gray sandstone comes next, making a prairie about three miles wide, so that to estimate its thickness is difficult, though there can scarcely be less than 300 feet. The sandstone furnished several badly preserved fossils among which were *Inoceramus*, *Gryphæ*, and *Scaphites warreni* M. & H. While the Ammonites are described as Fort Benton, inasmuch as I found the same at locality *c* mixed with the Fort Pierre Gasteropoda and Lamellibranchiata, and being strongly influenced by the stratigraphy, I am inclined to consider the sandstone bed Fort Pierre. Across the sandstone the Niobrara clay reappears, on its northern boundary nearly horizontal, but on the southern side overthrust, so that the Fort Benton lies inverted over the Niobrara. The Fort Benton dips 60° to the south (strike N. 48° E.). The change to the vertical occurs in the Dakota, which at this exposure (Carleton ridge) is only about one-half its usual thickness. The Jurassic dips 80° N. but as the Triassic is crossed the dip decreases to horizontal, changes to south, and gradually increases to about 17° S., at which angle most of the rocks, as far as the Prager anticline, dip. The section goes only to Como Bluff but the rocks at Prager anticline again show overthrust characteristics.

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[1] The collection included *Inoceramus*, *Gryphæa*, *Lucina subundata* H. and M., *Tellina*, cf. *scitula* M. and H., *Anisomyon shumardi* W., *A. Patellaformis* W., and *Scaphites warreni* M. and H.

[2] The Jurassic layers carried *Belemnites densus* M. and *B. curtus L.*

Three sections of the Jurassic are shown in Plate XXVII, Figs. 1, 2, and 3, giving the details of the series of rocks on the south side of Medicine anticline, and the north and south sides of the Como anticline. These sections are also tabulated on page 192 so that each layer can be traced in its variations across the two anticlines.

The base of the Jurassic I have located at the beginning of the series of clays. The Triassic is a great bed of sandstones, usually alternating red and gray. The first change from this to Jurassic is a layer of brown clay (No. 2), always of considerable thickness, and carrying *Belemnites densus* M. and *B. curtus* L. in such abundance that the ground is in many places so strewn with the shells that one can scarcely step without treading on one. The layer is widespread, occurring on Sheep Creek,[1] Medicine and Como anticlines, and is identical with Knight's No. 14,[2] and the lower part of Logan's No. 13.[3] It is usually designated as the Belemnite layer.

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[1] The Sheep Creek exposures are 12 miles northeast of Bone Cabin Quarries.
[2] Bull. Geol. Soc. Amer., Vol. XI, p. 382.
[3] Kan. Univ. Quart., Vol. IX, p. 112.

PLATE XXVII, FIG. 3.			PLATE XXVII, FIG. 1.		PLATE XXVII, FIG. 2.	
Bed.	Section A–B.	Thickness.	Section C–D.	Thickness.	Section E–F.	Thickness.
		Feet.	*Dakota.*	Feet.		Feet.
No. 33	Yellowish sandstone	243	Straw yellow sandstone	120+	Sandstone	200+
" 32	Black sandstone	2	Black sandstone	3	Black and red sandstone	4
" 31	Gray sandstone	30	Yellow sandstone	12	Straw yellow sandstone	20
			Jurassic.			
" 30	Bluish green clay	21	Bluish green clay	20	Maroon clay	10
					Bluish green clay	15
" 29	Green clay	20	Green clay	40	Yellow green clay	13
					Bluish green clay	15
" 28*a*	Flint	$\frac{1}{3}$	Flint	$\frac{1}{3}$		
" 28	Gray sandstone	10			Sandy clay	5
" 27	Concretions	2				
" 26	Green clay	3	Green clay	15	Green clay	2
" 25	Concretions	$1\frac{1}{2}$	Concretions	2	Concretions	1
" 24*a*	Green clay	8	Green clay	9	Green clay	15
" 24*b*					Sandstone	4
" 24*c*					Green clay	10
" 23	Green clay with small concretions	10	Green clay with small concretions	9	Green clay with small concretions	25
" 22	Maroon clay with small concretions	10	Maroon clay with small concretions	28	Maroon clay with small concretions	20
" 21	Sandstone	3				
" 20	Green clay	8	Green clay	20	Green clay	9
" 19	Sandstone	1	Sandstone	2		
" 18	Red clay	5			Red clay	5
" 17	Sandstone	2				
" 16	Green clay	6	Green clay	9	Maroon clay	7
" 15	Sandstone	$1\frac{1}{2}$	Sandstone	2		
" 14	Red, green, maroon clay	12	Green, maroon, red clay	26	Red clay	8
" 13	Sandstone	2	Sandstone	$1\frac{1}{2}$	Gray sandstone	28
" 12	Maroon, green, red clay	10	Green clay	20	Dark green clay	10
" 11	Sandstone	2	Sandstone	2	Sandstone	$1\frac{1}{2}$
" 10	Green clay	22	Green clay	60	Red and green clay	10
" 9	Sandstone	1	Sandstone	$1\frac{1}{2}$	Sandstone	2
" 8	Green clay	20	Maroon clay	20	Green clay	25
" 7	Reddish clay	20				
" 6	Sandstone	$1\frac{1}{2}$	Sandstone	$1\frac{1}{2}$	Sandstone	12
" 5	Green sand shale	6				
" 4	Purple clay with limestones	22	Purple clay with limestones	20	Purple clay with limestones	15
" 3	Nucula limestone	1				
" 2	Brown clay	43	Brown clay with limestone beds	70	Gray brown clay	55
	Total of Jurassic	$274\frac{5}{6}$		$378\frac{5}{6}$		$332\frac{1}{2}$
" 1	Triassic sandstones.		Triassic sandstones.		Triassic sandstones.	

On the surface of this, in Bone Cabin Draw, is found a one-foot bed of limestone (No. 3) made up mostly of *Nuculas*,[1] with occasionally a *Tancredia* and *Ostrea*. The band is not continuous, but similar layers at the same horizon occur both on Sheep Creek and in the Freezeout Hills.

No. 4 is a purplish clay with large limestone nodules scattered through it. It is in or on these nodules that the specimens of *Baptanodon* are found. That of the American Museum was found at locality *b*, at the foot of Bone Cabin Draw. It seems best to confine Marsh's[2] term, Baptanodon beds, to this layer instead of designating the whole lower Jurassic by that term. The bed is universally present in neighboring localities; and is Knight's 12 and the upper part of Logan's 13.

No. 5, green sand shale, is local.

No. 6, sandstone. This first sandstone bed seems to be widely distributed, and marks the beginning of a series of alternations between sandstone and clay. The clays are variously and brightly colored and often designated as the 'variegated clays.' The layers from 6 to 20 inclusive form a series of variegated beds in which there may be eight sandstone layers or only three. Very few of the clays seem to form wide horizons. Inside of a quarter of a mile I have seen three of the sandstone beds unite into one thick sandstone, the intervening clays being pinched out. These indicate a period of shallow water in which there were continually changing currents, so that deposits from any given source are laid down first in one place, later in another. In the Bone Cabin section there are 120 feet of these variegated clays, and it is somewhere in these layers that the change from marine to brackish (or freshwater) deposits occurs. In the Como section there is a 28 foot bed of sandstone, corresponding apparently with No. 13, in which a Dinosaur quarry (12) is located. This bed seems to represent the beginning of the freshwater (or brackish) series, and as such is the first member of the Como stage (Atlantosaurus beds). This sandstone (No. 13) is variable in thickness but there is no unconformity such as Logan seems to have found in the Freezeout Hills.

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[1] At the foot of Bone Cabin Draw, locality *b*, were found in this layer *Nucula* nov. sp., *Tancredia inornata*, *Avicula mucronata*, and *Ostrea strigilecula*. A similar band near Sheep Creek furnished all of the above with also *Cardioceras cordiformis* M., and *Pseudomonotis curta;* see also Logan's No. 13, which furnished some of these and several other forms.

[2] Sixteenth Ann. Rep. U. S. Geol. Surv., 1896, p. 145.

No. 22 is a bed of maroon colored clay with small limestone concretions scattered through it, and is a most excellent horizon indicator, for it is everywhere present, and its brilliant color makes it a conspicuous feature for miles. At Bone Cabin it is but 10 feet thick but increases to 30 feet in the Como Bluff. The considerable amount of concretionary limestone would seem to indicate brackish water.

The maroon clay graduates into a bed of green clay with similar small limestone concretions (No. 23). This layer like the maroon bed is widespread and thicker as one goes south.

The green clay with concretions is invariably covered with smooth green clay (No. 24). In the Como Bluff this layer has sandwiched into it a 4-foot bed of sandstone (24*b*). The sandstone is of interest as marking the horizon at which the few known Jurassic mammals were found. The mammal layer is the 6 inches of clay immediately underlying this sandstone. Most of the American Jurassic mammal remains thus far found have come from one quarry,[1] worked most successfully by Marsh and later by the American Museum. This pocket seems to be exhausted.

Above 24 is a constant layer of large nodular limestone concretions (No. 25). Single concretions may occur anywhere in the clay but this layer and No. 27 are definite layers of almost uninterrupted limestone nodules. The concretion layers are of considerable importance as, when weathered out, they make a prominent line on the bluffs just above which the most important bone bed occurs. In this limestone layer Logan found five species of fresh or brackish water mollusks.[2]

No. 27 is a green clay of varying thickness in which the most numerous quarries are located. On weathering, or having been dried out, this clay breaks into angular fragments and is therefore known as 'joint clay.' The 'Nine Mile Quarry,' the 'Aurora 1900 Quarry,' the 'Diplodocus 1897 Quarry,' and several of Marsh's quarries are in this layer. Most of the fossils are *Diplodocus* and *Brontosaurus* species.

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[1] See Pl. XXVI, the S.E. corner of the map.

[2] *Unio knighti* L., *U. willistoni* L., *U. baileyi* L., *Valvata leei* L., and *Planorbis veternus* L.

In Bone Cabin Draw this green clay is overlaid by a second layer (No. 27) of concretions, so that the 'Nine Mile Quarry' is between two such layers.

No. 28 is a gray sandstone in which the rich Bone Cabin Quarry is situated, and also the Stegosaurus Quarry. The sandstone varies extremely in hardness, being, in the south part of Bone Cabin Quarry, soft and mixed with considerable clay so that it is workable with an awl. In the northern part of the quarry, however, there are bands of the firmest sort of sandstone. In Como Bluff the layer is clay with merely an admixture of sand. Bone Cabin Quarry has yielded a great variety of genera: *Diplodocus*, *Morosaurus*, *Brontosaurus*, *Allosaurus*, *Ceratosaurus*, *Camptosaurus*, *Stegosaurus*, as well as several genera of carnivorous Dinosaurs; also *Compsemys* and *Goniopholis*.

On the surface of this sandstone is usually a 4-inch layer of flint, No. 28*a*.

No. 29 is another green clay showing the 'joint' structure similar to No. 26. Several of Marsh's quarries are in this layer.

The series ends with a soft bluish green clay in which I have never seen fossils. This completes the Jura.

A cap of Dakota sandstone overlies the Jura, near the base of which is a narrow (2–6 feet) band of soft black, or occasionally red, sandstone. This band is colored by iron and of interest as having lately yielded a collection of bones probably crocodilian.

There is some difficulty in comparing the foregoing sections with those of Logan and Knight, as these authors give fewer beds. Marsh divided the Jura into three horizons, Hallopus, Baptanodon, and Atlantosaurus beds. The Hallopus beds do not occur in southeastern Wyoming. The Baptanodon beds, according to Marsh, included all of the lower Jurassic, which has since been subdivided, but the term Baptanodon is now applied to a single layer (No. 4) in which these reptiles occur. When this term is restricted to a single layer, the lower strata are without designation; so for these, Knight has proposed the term Shirley stage, which shall include all the marine Jura; that is, beds 2–12 inclusive. The exact boundary between marine and non-marine is difficult to locate, but bed 13 has furnished some Dinosaur remains and may therefore be associated with the beds in which Dinosaurs are abundant. Then beds 13–30, inclusive, would form the non-marine upper Jura. There are no invertebrate forms of decisive character in these beds to determine between brackish and fresh water, but those found in bed 24 would incline toward fresh water. The change is clearly a gradual one. These upper beds Marsh calls Atlantosaurus beds, but as that genus has proved to be a synonym with *Camarosaurus*, a less misleading term is desirable; and Scott[1] has introduced the name Como stage for exactly these beds. He suggests that they belong to the Lower Cretaceous; and Logan also uses the term Atlantosaurus beds as distinct from Jurassic. There is no available invertebrate material in these upper beds for comparisons; but the strikingly close relationships between the British Purbeck mammalian fauna and the Wyoming mammals cannot be left out of consideration. The considerable number of British and Wyoming genera which are closely related will compel us to consider the Como stage of nearly if not just the same age[2] as the Purbeck and retain the Como in the Jurassic series. It is true there is no apparent unconformity between the Como and Dakota, as would be expected if this Como stage were dry land for a period as long as the Lower Cretaceous.

During the Shirley period, the deposits on the Medicine and Como anticlines were being laid down quite close to shore, as appears from the fact that within 30 miles to the south the Shirley is unrepresented, and all of the deposits are strictly shallow water sediments. However, during and especially at the beginning of the Como stage, a considerable transgression took place (see Knight's map) toward the south, removing the shore line to over 100 miles south. The deposits are also of shallow water.

The Dinosaur remains could, however, have travelled such considerable distances by floating. There could have been no currents in the Como lake strong enough to transport gigantic bones, for they were depositing clay. The bones are clearly floated out to sea by the presence of considerable meat on them. Most specimens must have started as complete carcasses, which with decay of the flesh (or its consumption by crocodiles and fish) have fallen apart, often making series of vertebræ, etc. Doubtless such quarries as the Bone Cabin Quarry mark an eddy, as there all sorts and sizes of animals are collected together.

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[1] W. B. Scott, Introduction to Geology, p. 477.

[2] Osborn, Jour. Acad. Nat. Sci. Phila, (2) IX, p. 187, 1888.

In summary it may be said that the Dinosaur remains are mostly confined to beds from 26 to 29, although occasionally remains are found lower. The bones are usually nearly perfect, though in some localities pieces of the more delicate spines are broken away. The clay usually preserves bones much better than the sandstone.

Article XIII. — FORE AND HIND LIMBS OF SAUROPODA FROM THE BONE CABIN QUARRY.

Dinosaur Contribution No. 6.

By Henry F. Osborn and Walter Granger.

During the early months of 1900 the large collection of limb bones from the Bone Cabin Quarry was measured and compared by Mr. Granger in preparation for this paper. Measurements are chiefly of value in determining *proportions;* size, of course, constantly increasing with age. Further studies during the present year enable us to establish the following points:

1. The proportions and relations of the radius and ulna in the Sauropoda are remotely analogous or parallel with those of the Proboscidia, owing to the marked extension of the ulna, the similar weight, and the perfected quadrupedal progression in the two types.

2. The chief characters of the fore and hind limbs and of the upper part of the manus of *Diplodocus.*

The conclusion reached provisionally by Osborn,[1] that Diplodocus was a distinctively long-limbed type, is abundantly confirmed. The bones of the fore and hind limbs of *Diplodocus* can, in fact, be readily identified by their relative length and slenderness as compared with those of *Morosaurus* and *Brontosaurus* (see Fig. 6).

3. The carpus in the Sauropoda includes the probable coösification of the radiale and intermedium into a "scapho-lunar"; also a large ulnare, and from two to three small osseous carpalia in the distal row.

In his numerous and valuable contributions to this group the late Professor Marsh left the homologies of the carpals undetermined; his figures (of the *Morosaurus* and *Brontosaurus* fore limb) do not indicate the anterior crossing of the radius and ulna; he also left the limb structure of *Diplodocus* practically unknown.

In general, the limbs of the three contemporary Sauropoda of the Como district can be distinguished as follows:

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[1] Fore and Hind Limbs of Carnivorous and Herbivorous Dinosaurs from the Jurassic of Wyoming. Bull. Amer. Mus. Nat. Hist., Vol. XII, 1899, pp. 161–172.

Morosaurus, scapula relatively short, spreading superiorly; scapulo-coracoid plate relatively broad; limbs intermediate in length; tibia, fibula and metapodials relatively slender.

Brontosaurus, scapula long, narrow superiorly; scapulo-coracoid plate relatively narrow; limbs long and heavy; tibia, fibula and metapodials relatively robust.

Diplodocus, scapula expanding superiorly with intermediate scapulo-coracoid extension, limbs long and relatively slender, tibia and fibula, radius and ulna, and metacarpals especially elongated.

Camarasaurus, thus far found only in the Colorado Jurassic, is not related to *Brontosaurus*, as Osborn formerly supposed, but is a *Morosaurus* of immense size. The type skeleton will shortly be described.

The distinctive scapulo-coracoid characters are clearly brought out in the accompanying figures (Fig. 1, A, B, C).

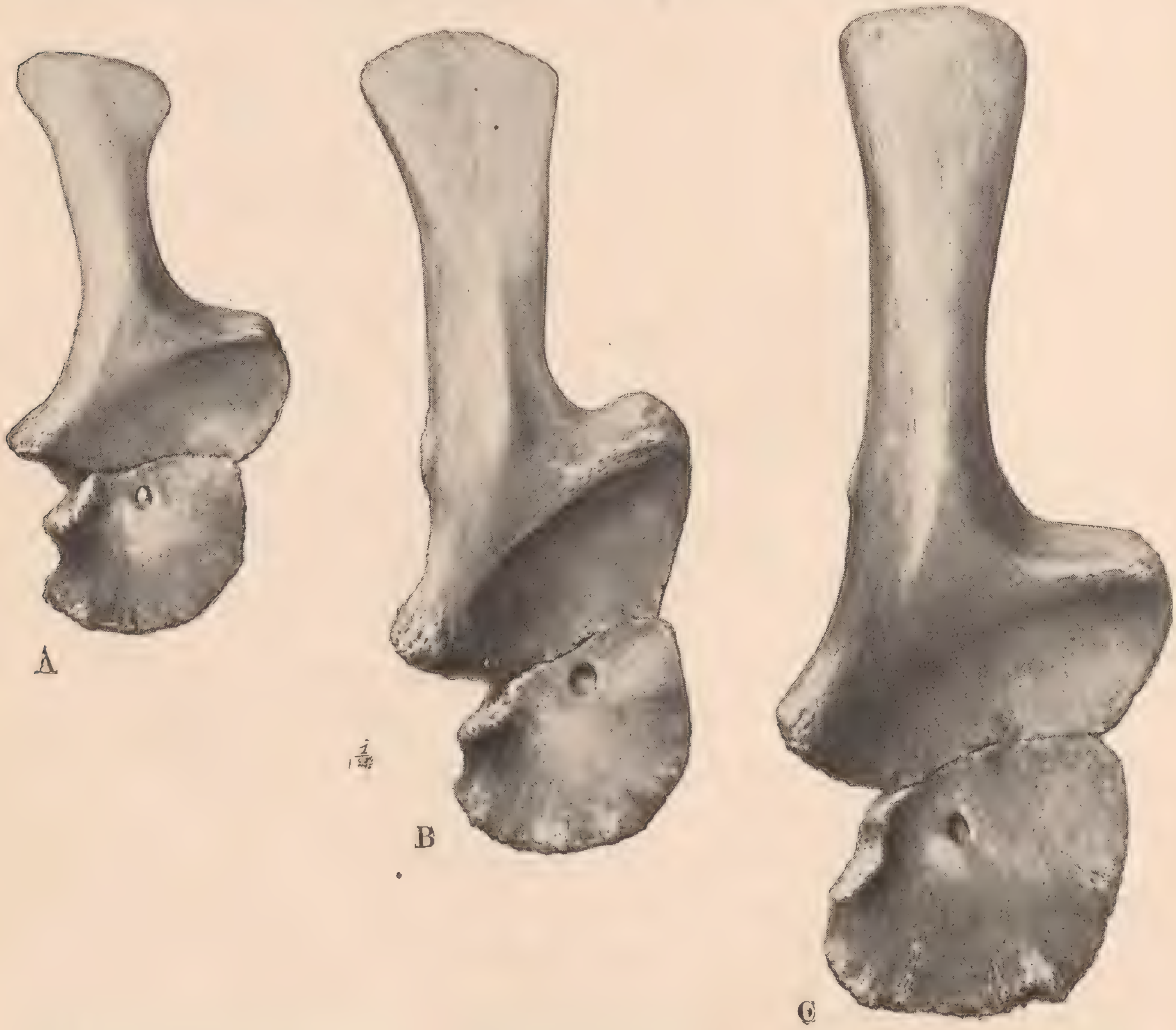


Fig. 1. Scapulo-coracoid of: A. *Morosaurus*, Amer. Mus. Coll. No. 332; B. *Diplodocus*, Amer. Mus. Coll. No. 221; C. *Brontosaurus*, Amer. Mus. Coll. No. 222. All from the Bone Cabin Quarry. $\frac{1}{24}$ nat. size.

Fore Limb of Diplodocus, No. 594.

In the portion of the quarry explored during 1900, within an area of about 20 feet, were found a scapula and a coracoid which

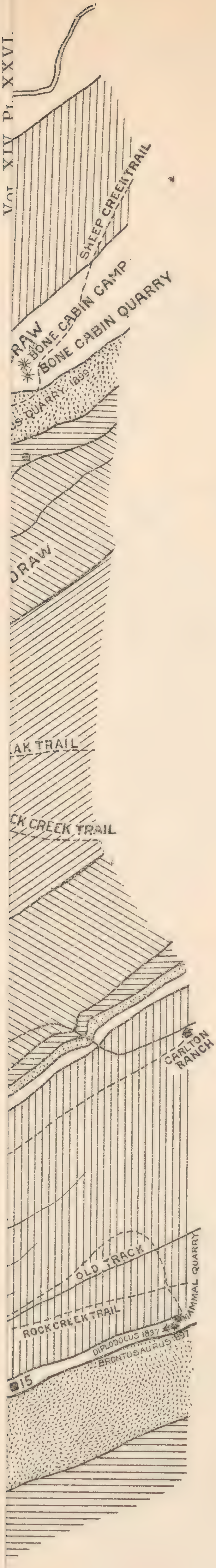
EXPLANATION OF PLATE XXVI.

Fig. 1.—Map of southeastern Wyoming, showing exposures of Jurassic. The shaded area represents the accompanying map, Fig. 2. This map is a reproduction of Knight's (see page 189).

Fig. 2.—Map as indicated on Figure 1, showing position of quarries and fossil localities on Medicine and Como anticlines; also positions of sections made through the Jurassic, as follows:

A–B, section of Jurassic on Plate XXVII, Fig. 3.
C–D, section of Jurassic on Plate XXVII, Fig. 1.
E–F, section of Jurassic on Plate XXVII, Fig. 2.
L–H, section across Medicine and Como anticlines, Plate XXVI, Fig. 3.
16, quarry of the American Museum (Dinosaur).
13, Marsh's Stegosaurus quarry.
12, quarry in bed No. 13, author unknown.
10, 11, 14, 15, quarries made by Marsh.
* Quarries of American Museum.

Fig. 3.—Ideal section across Medicine and Como anticlines, as the strata would have appeared had no erosion taken place.


SHEEP CREEK TRAIL
RAW
BONE CABIN CAMP
BONE CABIN QUARRY
S QUARRY 1898
DRAW
AK TRAIL
CK CREEK TRAIL
CARLTON RANCH
OLD TRACK
MAMMAL QUARRY
ROCK CREEK TRAIL
DIPLODOCUS 1897
BRONTOSAURUS 1897
15

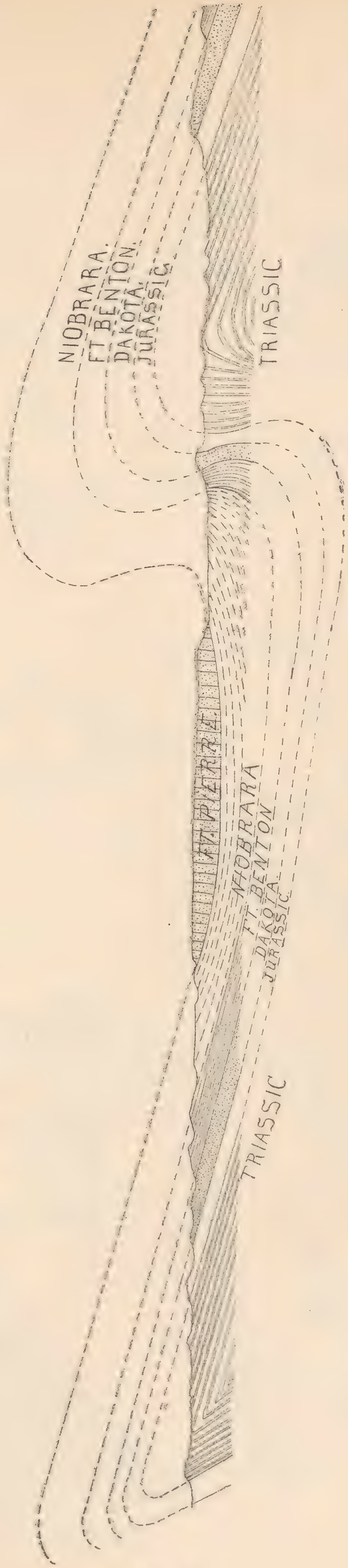

NIOBRARA.
FT BENTON.
DAKOTA.
JURASSIC.
TRIASSIC
FT. PIERRE.
NIOBRARA
FT. BENTON
DAKOTA
JURASSIC
TRIASSIC

Fig. 3.

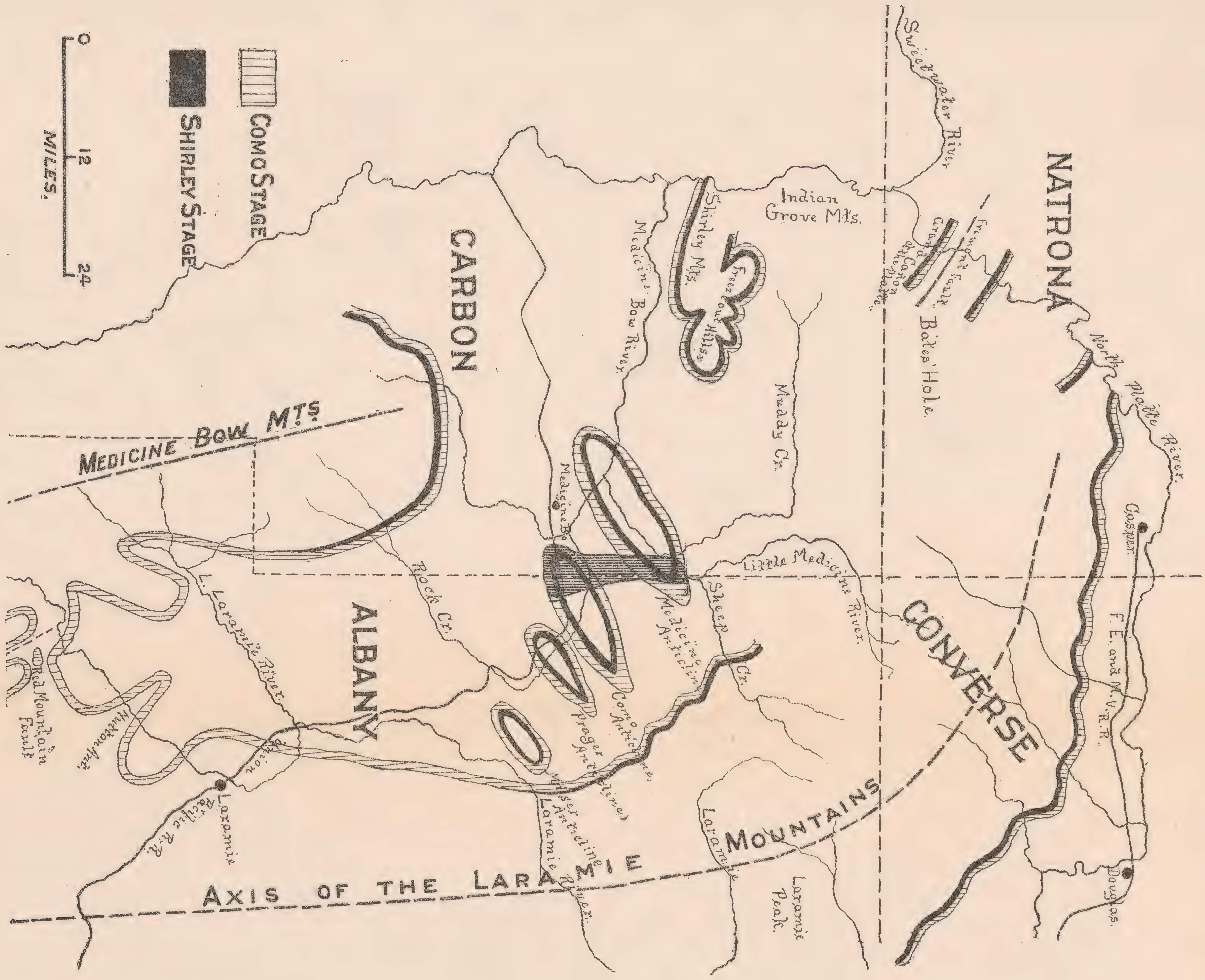


Fig. 1.

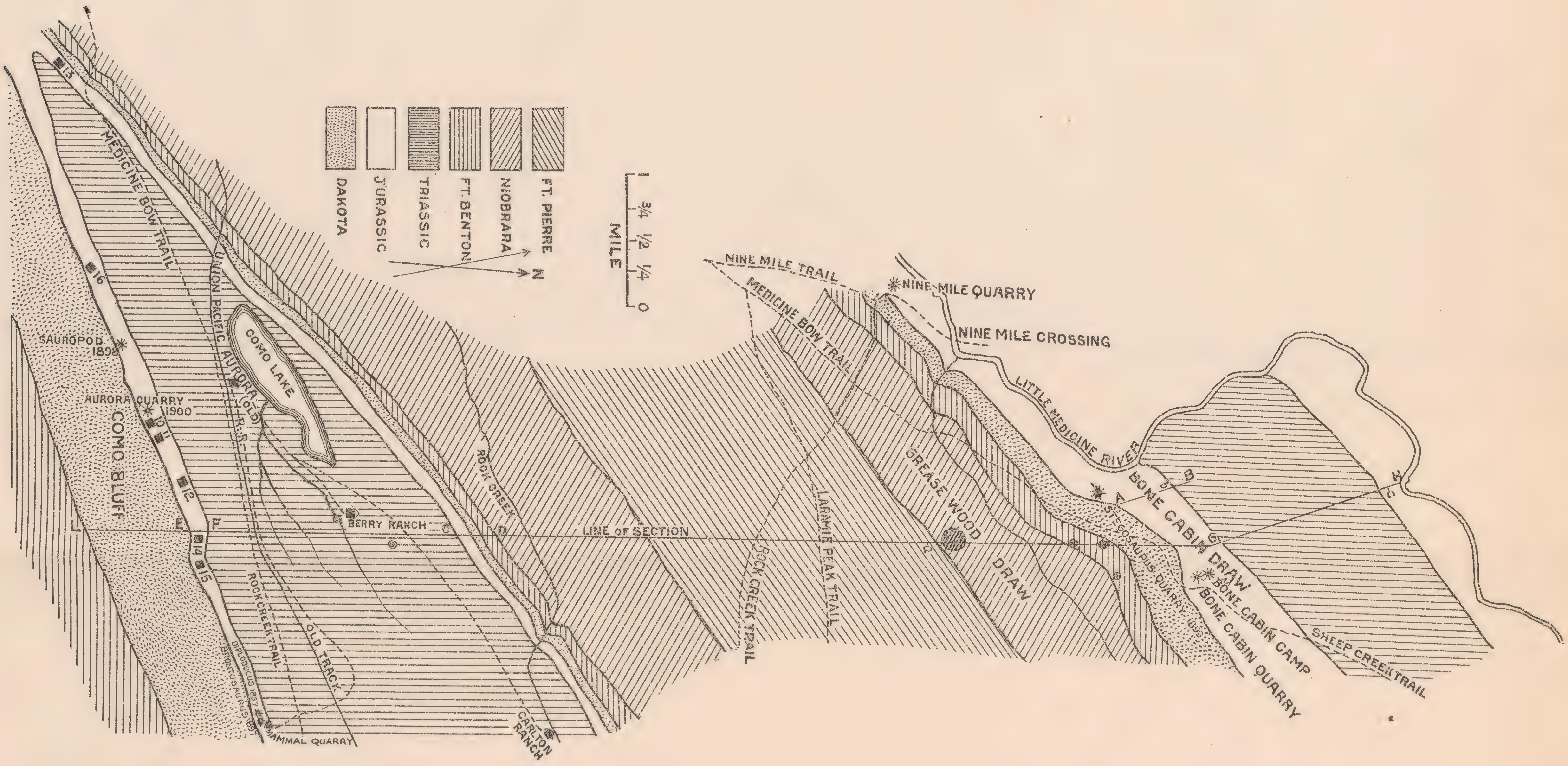


Fig. 2.

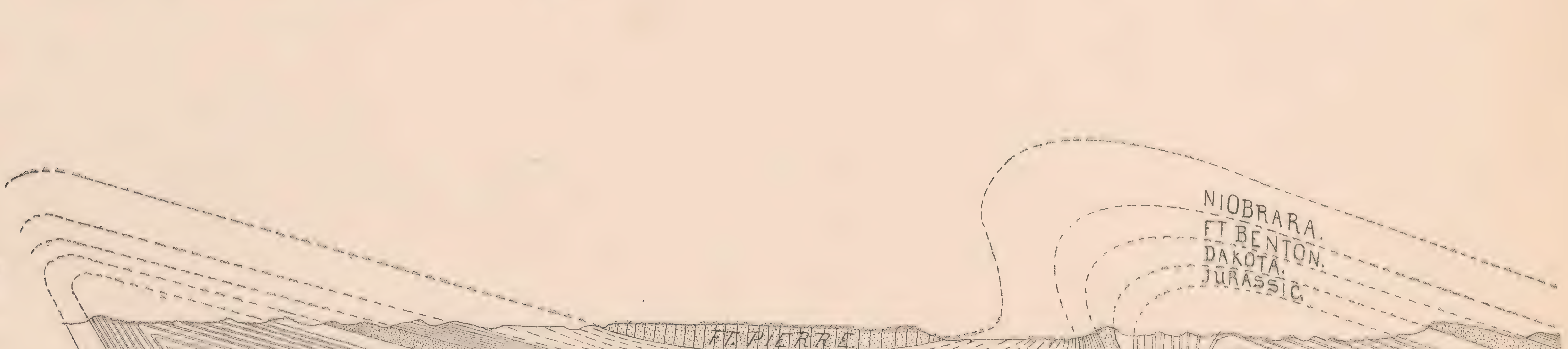


Fig. 3.

EXPLANATION OF PLATE XXVII.

Fig. 1.—Jurassic section across Carleton ridge, north side of Como anticline; C–D on Plate XXVI, Fig. 2.

Fig. 2.—Jurassic section across Como Bluff, south side of Como anticline; E–F on Pl. XXVI, Fig. 2.

Fig. 3.—Jurassic section across Bone Cabin Draw, south side of Medicine anticline; A–B on Pl. XXVI, Fig. 2.

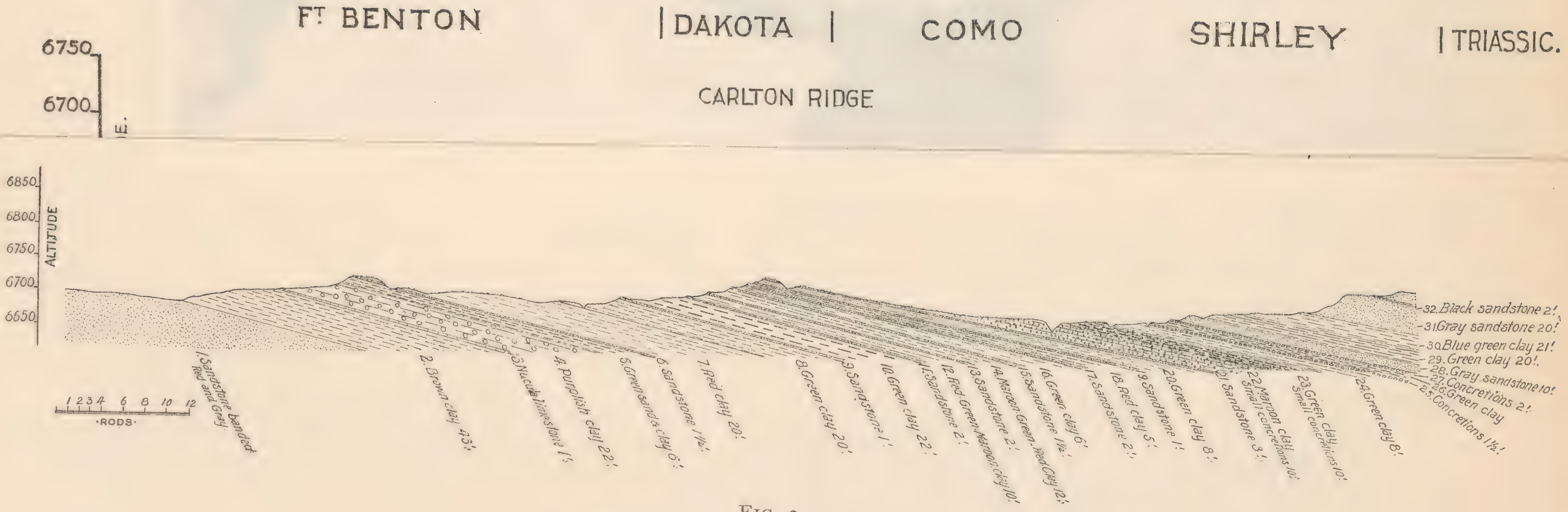

6750
6700
E.
FT. BENTON
DAKOTA
COMO
SHIRLEY
TRIASSIC.
CARLTON RIDGE
6850
6800
6750
6700
6650
ALTITUDE
1 2 3 4 6 8 10 12
·RODS·
1. Sandstone banded Red and Gray
2. Brown clay 43'.
3. Nucula limestone 1'.
4. Purplish clay 22'.
5. Green sand & clay 6'.
6. Sandstone 1½'.
7. Red clay 20'.
8. Green clay 20'.
9. Sandstone 1'.
10. Green clay 22'.
11. Sandstone 2'.
12. Red-Green-Maroon clay 10'.
13. Sandstone 2'.
14. Maroon-Green-Red Clay 12'.
15. Sandstone 1½'.
16. Green clay 6'.
17. Sandstone 2'.
18. Red clay 5'.
19. Sandstone 1'.
20. Green clay 8'.
21. Sandstone 3'.
22. Maroon clay Small concretions 10'.
23. Green clay Small concretions 10'.
24. Green clay 8'.
25. Concretions 1½'.
26. Green clay
27. Concretions 2'.
28. Gray sandstone 10'.
29. Green clay 20'.
30. Blue green clay 21'.
31. Gray sandstone 20'.
32. Black sandstone 2'.

FIG. 3.

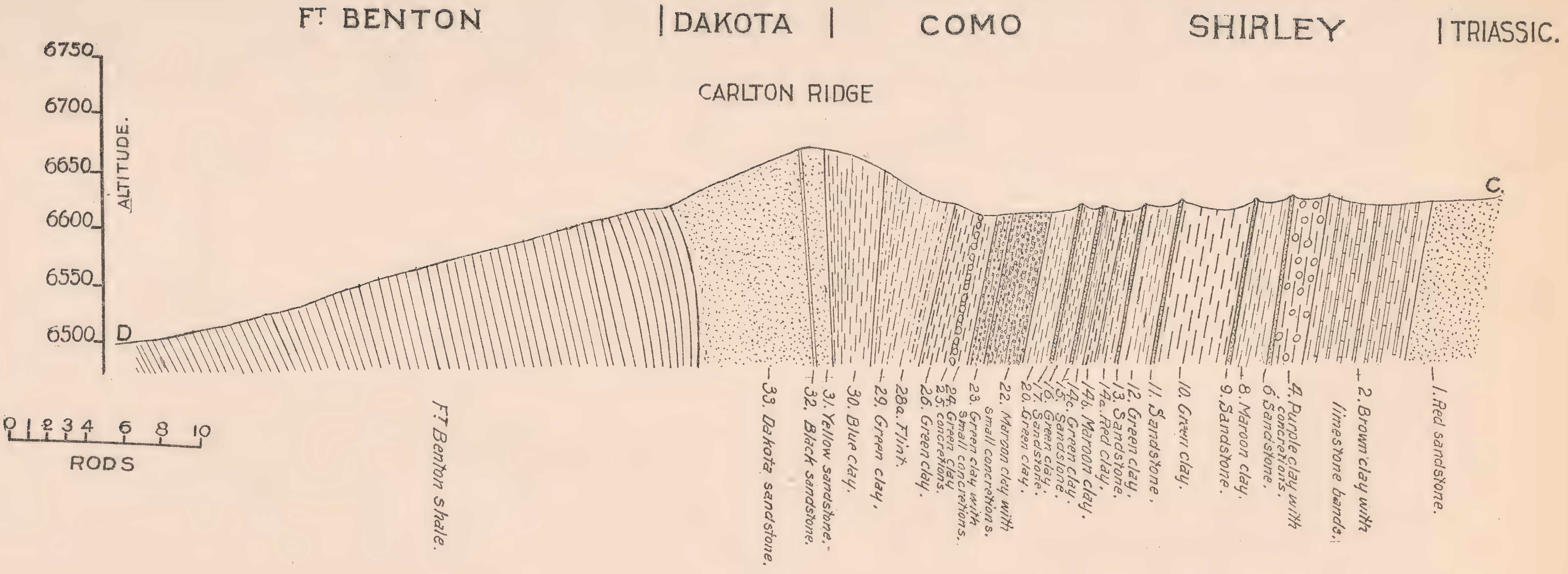


Fig. 1.

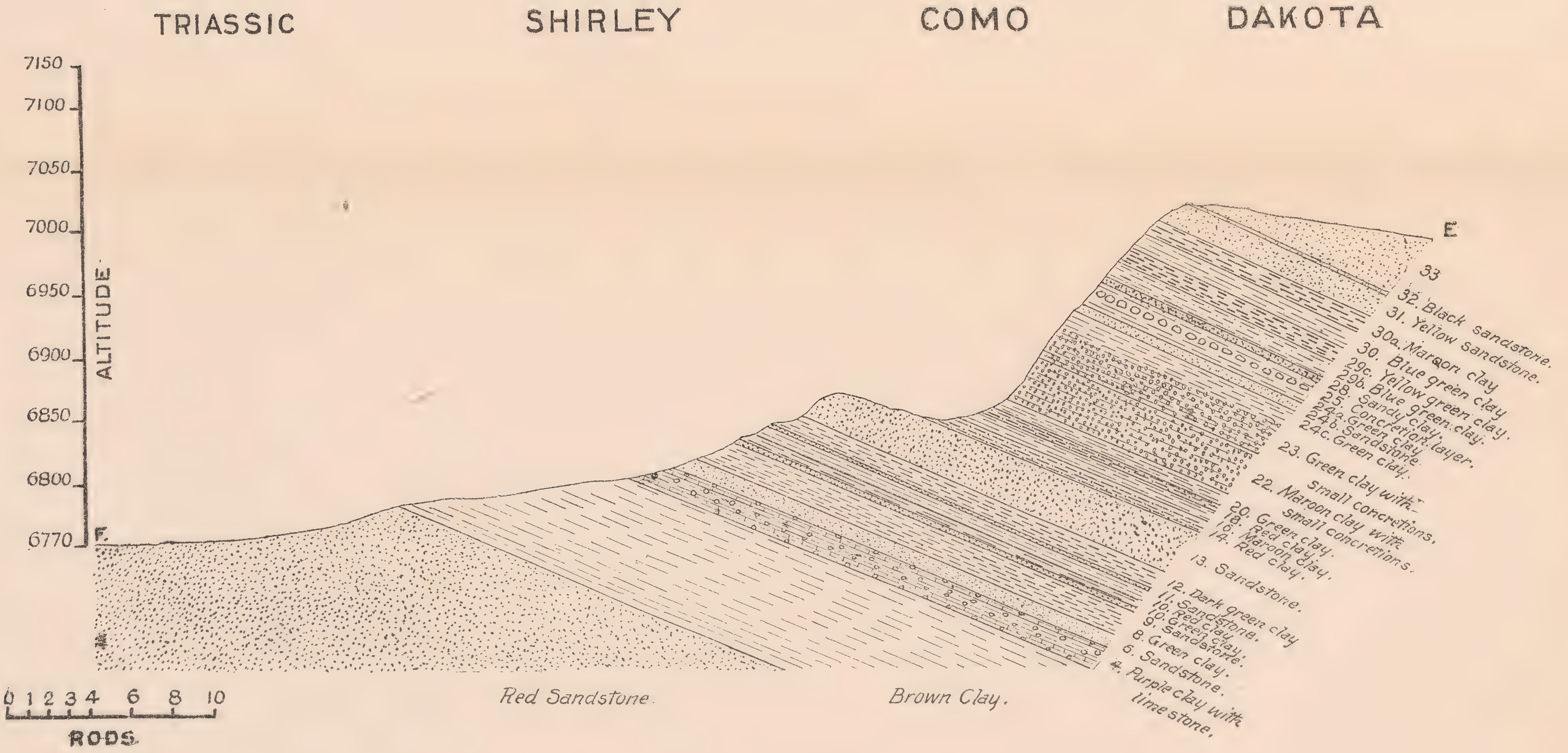


Fig. 2.

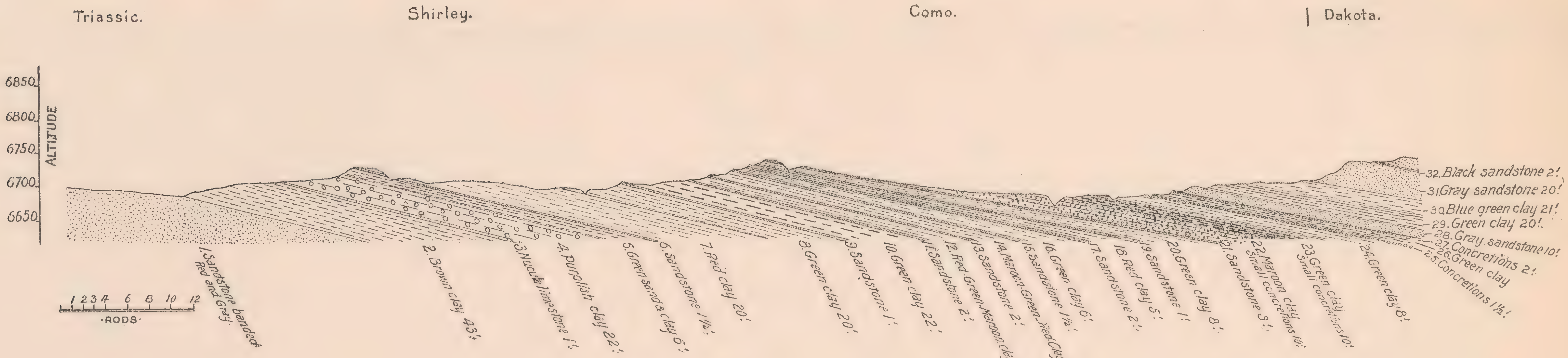


Fig. 3.

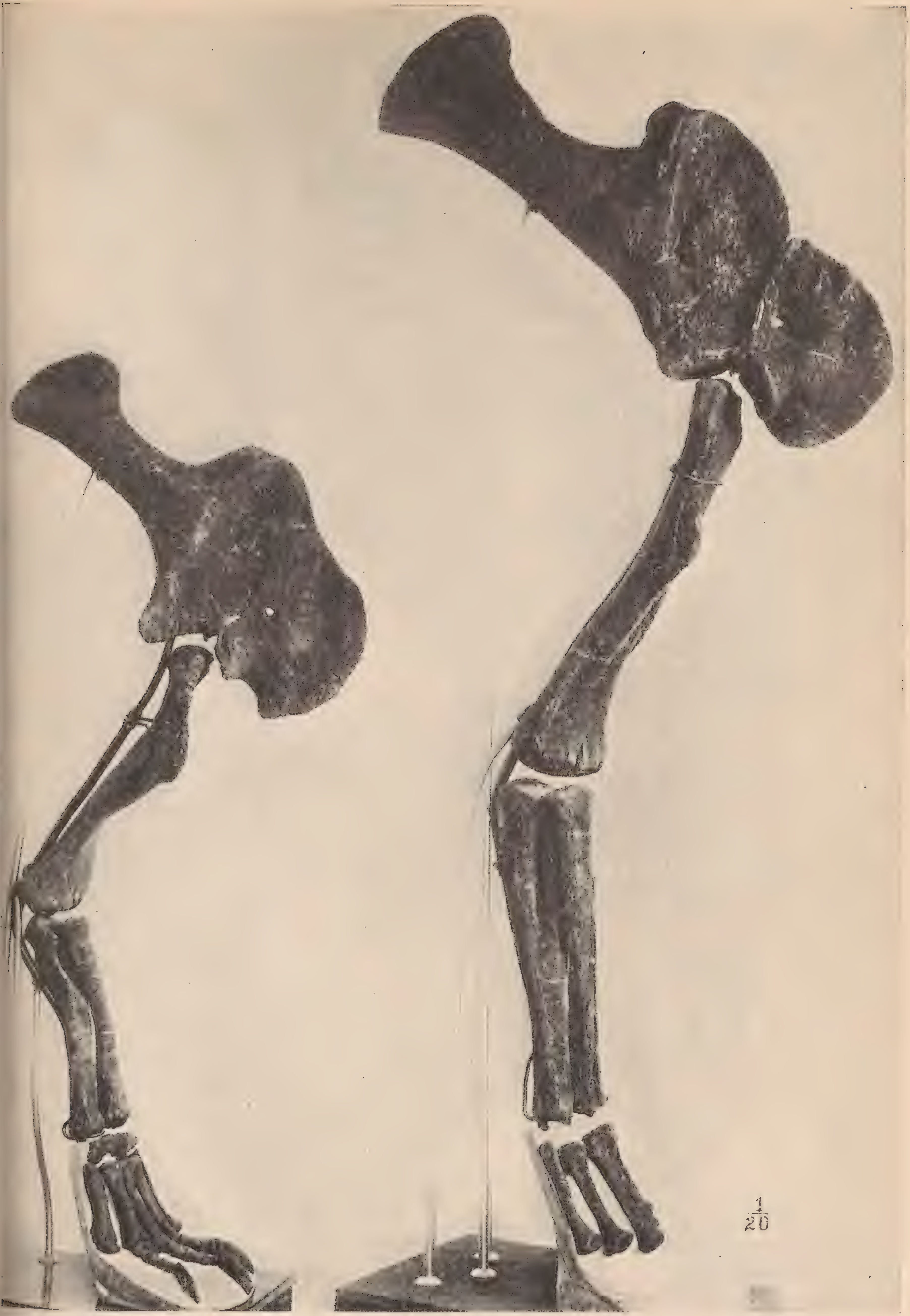


Fig. 2. Fore limbs of *Morosaurus* Amer. Mus. Coll. No. 332, and of *Diplodocus* Amer. Mus. Coll. No. 594. $\frac{1}{20}$ nat. size.

fits closely to it, a humerus, ulna and radius lying together on the right side associated with a humerus of the left side; five metacarpals at some little distance associated with metatarsals and a hind limb of *Diplodocus.* These bones were considerably scattered and assigned separate field numbers, but they belong in all probability to one individual of medium size. They have been prepared and mounted (Fig. 2) under the direction of Mr. Hermann and afford for the first time a fine example of the fore limb of this stilted Dinosaur. Although the scapula is inclined backwards, the upward portion of the blade is 10 feet 6 inches, or 3195 mm. from the ground. The scapula is practically identical in measurement with that of the skeleton described in Osborn's Memoir upon *Diplodocus.*

The principal measurements (in millimeters) are as follows:

Scapula, length	1285
" greatest breadth	500
Scapulo-coracoid conjoined	1650
Coracoid, breadth from glenoid border	425
Humerus, length	1080
" least circumference	470
Ulna, length	870
" least circumference	285
Radius, length	840
" least circumference	255

Metacarpals	I,	II,	III,	IV,	V.
Proximal facets, antero-posterior	105 e.[1]	113	76 e.	63	85
" " transverse	51	64	83	85	43
Length	260	290	315	290	285

The *scapula* is very similar in form to that already described by Osborn. The *coracoid* is short, not yet conjoined to the scapula, and fortunately retains its natural curvature; on its postero-inferior surface is the rough facet, observed by Marsh, for articulation with the sternal plate. The sternals were also found, but have not been placed in position. The head of the upper portion of the shaft of the *humerus* is crushed, so that it extends unnaturally beyond the line of the glenoid facet; the deltoid or lateral crest (processus lateralis) extends well down upon the outer side of the shaft; distally the shaft terminates on the outer side in a prominent radial condyle which is readily distinguished by the deep groove upon its anterior face ; the lower articulation of the humerus indicates that the limb was not greatly flexed at the elbow in the standing position, a fact in keeping with the great weight of the anterior portion of the body. In an uncrushed humerus the ulnar condyle is also well defined ; the ulna, however, extends around and behind the radius.

---

[1] e = estimated.

Proximally the *radius* articulates on the anterior outer side of the humerus with the radial condyle ; it fits in the broad anterior groove of the *ulna*, which element supports the entire posterior as well as the inner portion of the humerus, while the radius supports the anterior and outer portion only. The analogy of these elements with the fore limb of the elephant is obvious, because in both the proboscidian and dinosaurian the ulna is a stouter element than the radius, as shown by reference to the respective circumferences of the shafts, namely :

Diplodocus.		No. 594 mm.	No. 588 mm.
Ulna	=	285	290
Radius	=	255	265

The shaft of the radius also crosses that of the ulna completely, as in the elephant and other ungulate mammals. On the posterior face of the radius, in its upper fourth, is a stout tuberosity for the ligaments and muscles connecting this bone with the ulna. Distally, the radius and ulna present approximately equal facets for the carpals.

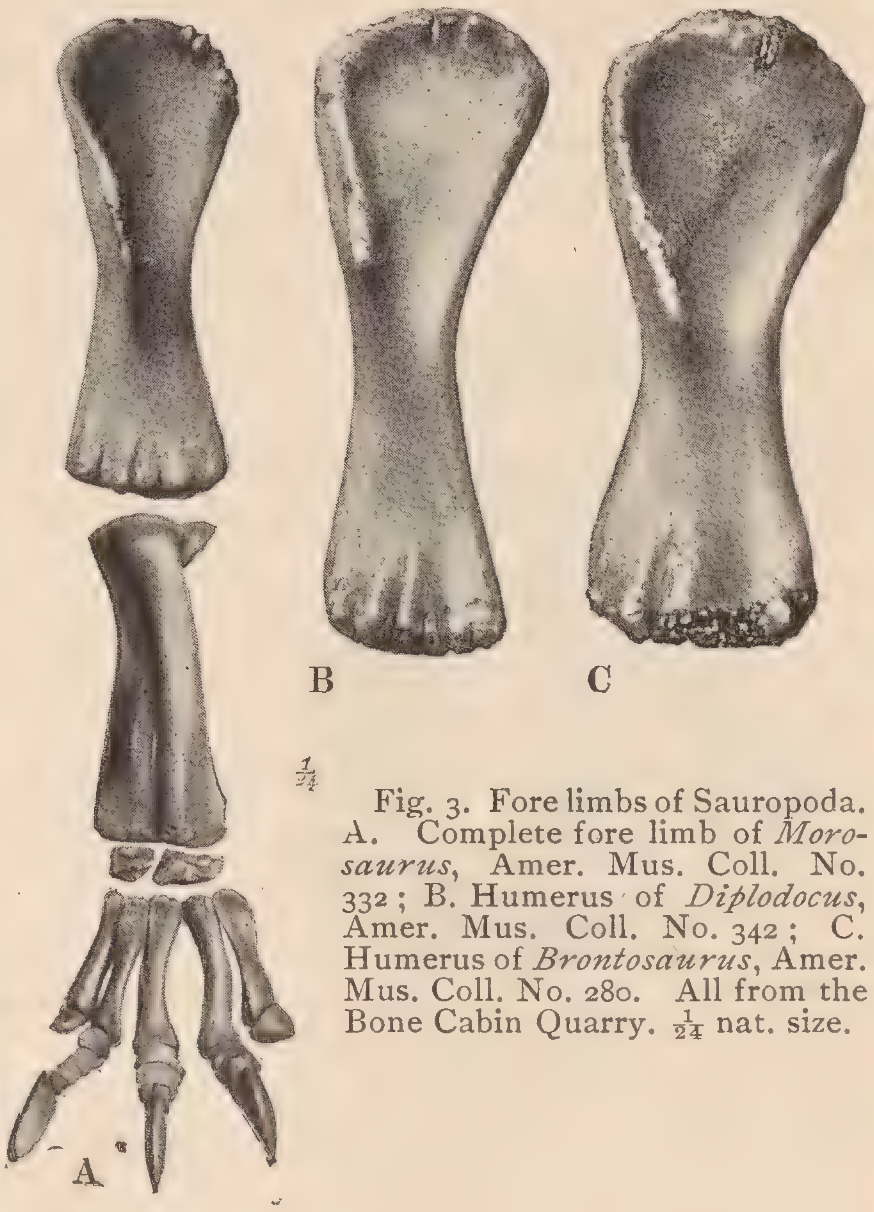


Fig. 3. Fore limbs of Sauropoda. A. Complete fore limb of *Morosaurus*, Amer. Mus. Coll. No. 332 ; B. Humerus of *Diplodocus*, Amer. Mus. Coll. No. 342 ; C. Humerus of *Brontosaurus*, Amer. Mus. Coll. No. 280. All from the Bone Cabin Quarry. $\frac{1}{24}$ nat. size.

Two *carpals* were found entirely out of position, making it difficult to determine their homologies ; the larger of these apparently belongs to the opposite side and, as the evidence is conflicting, reference must be made to another fore limb, No. 588, described below.

There is little question that the *metacarpals* belong to this fore limb, although they were found mingled with metatarsals of a hind limb of corresponding size. By comparison with several series of metatarsals belonging to *Morosaurus* and *Brontosaurus* in the American Museum Collection, their homologies can be determined. Examination of the proximal facets for articulation with the carpals, shows that Mtc. I is deep and relatively narrow ; Mtc. II is somewhat deeper and broader, and increases in size ; Mtc. III is less deep, but much broader in front ; Mtc. IV is still shallower, but of equal front breadth ; Mtc. V, like Mtc. I, is deep, but narrow in front. The measurements given above are much affected by crushing, but indicate that Mtc. III is the largest and stoutest of the metacarpals, while Mtc. I and Mtc. V are relatively short.

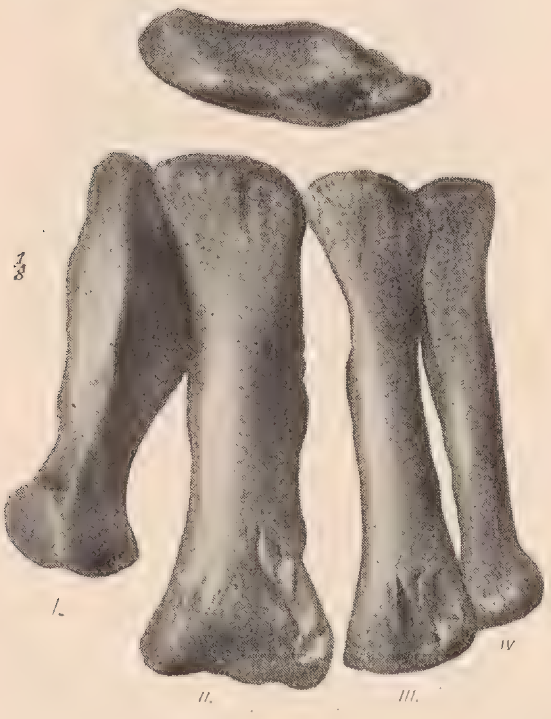


Fig. 4. Metacarpals, left manus, of *Diplodocus*, with supposed radiale plus intermedium. Amer. Mus. Coll. No. 588. $\frac{1}{8}$ nat. size.

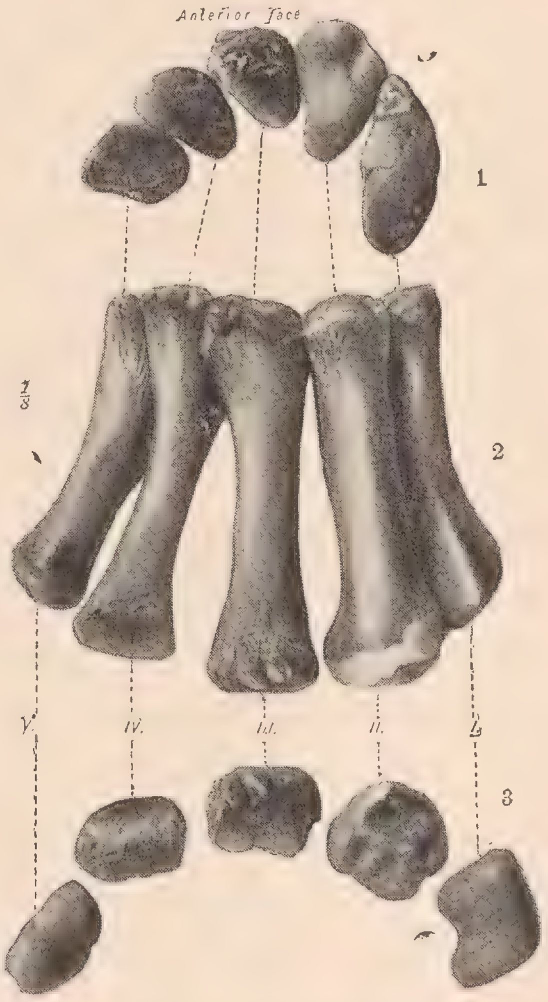


Fig. 5. Metacarpals of right manus of undetermined Sauropod, probably *Morosaurus*.
1. Proximal view of metacarpals.
2. Anterior view of metacarpals.
3. Distal view of metacarpals.
Amer. Mus. Coll. No. 462. $\frac{1}{8}$ nat. size.

FORE LIMB OF DIPLODOCUS, NO. 588.

The above characters are supplemented and confirmed by those of another fore limb (No. 588), consisting of ulna, radius, supposed scapho-lunar, supposed cuneiform, metacarpals I, II, III, IV, and a terminal phalanx. The metacarpals correspond approximately with those figured by Marsh.

Measurements.

	mm.
Radius, length	870
" least circumference	265
Ulna, length	910
" least circumference	290
Supposed scapho-lunar, transverse	151
Metacarpal I, length (vertically crushed)	235
" II, "	280
" III, length	280
" IV, "	265
Terminal phalanx (claw)	200

Carpals.—There can be little question as to the correctness of the association of these bones since they were found close together, and near by was a long series of *Diplodocus* caudals. Beneath the radius was found a large flattened carpal which from its connection with both radius and ulna is believed to represent a conjoined radiale and intermedium or scapho-lunar bone ; this bone is much thicker behind than in front ; it has a large radial facet, slightly concave, and a smaller oblique ulnar facet ; inferiorly there is a single convexity with ill-defined areas for the cartilaginous trapezium, trapezoid and magnum ; the cuneiform in this specimen is crushed beyond recognition ; there is a small ossicle which may represent the unciform or one of the other carpalia of the second row.

FORE LIMB OF DIPLODOCUS, NO. 380.

This generic reference is somewhat uncertain. The associated parts, consisting of radius, ulna, supposed scapho-lunar, cuneiform and two ossicles probably belong to a young *Diplodocus*. This limb is important, because it includes the terminal phalanges. The position of the latter, however, was not positively determined.

FORE LIMBS OF MOROSAURUS, NO. 332.

FIGS. 1, 2, 3.

The right and left manus found with these limbs have already been described by Osborn (*l. c.*, p. 168) ; the elements were found in position and therefore yield important information, although the limb bones are much crushed. As in *Diplodocus*, the radius crosses the ulna completely and rests upon the enlarged flattened scapho-lunar, which also presents a narrower face for the ulna ; as in *Diplodocus* this carpal is much thinner in front than behind.

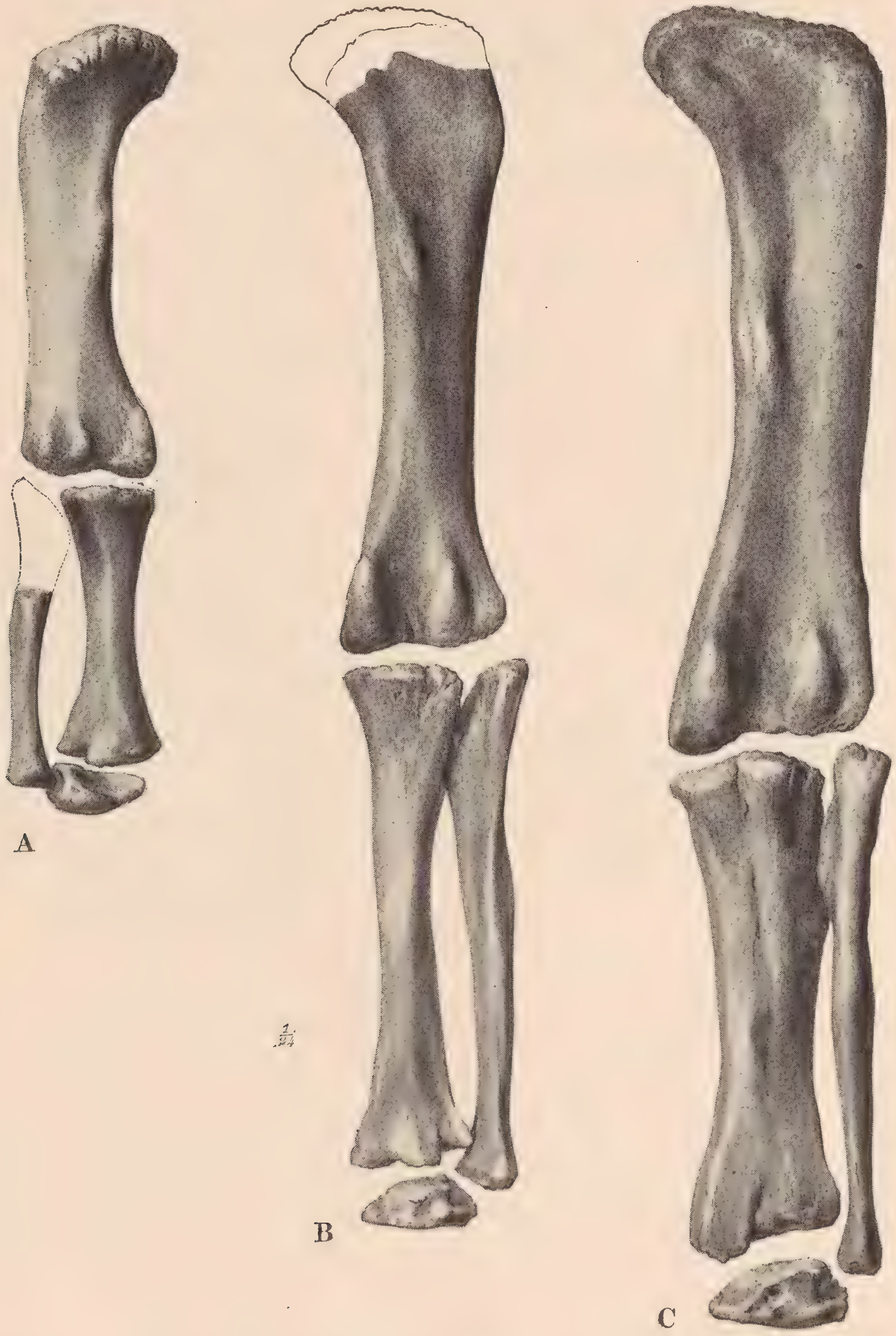


Fig. 6. Hind limbs of Sauropoda, posterior view. A. *Morosaurus*, Amer. Mus. Coll. No. 461 ; B. *Diplodocus*, Amer. Mus. Coll. No. 251 ; C. *Brontosaurus*, Amer. Mus. Coll. No. 353. All from the Bone Cabin Quarry. $\frac{1}{24}$ nat. size.

The cuneiform is a smaller bone, oval and flattened as seen from above, cyclindrical in anterior view, with an irregular projection on the lower face. The three median metacarpals are long and slender, decidedly exceeding in length the outer pair, Mtc. I and Mtc. V. The doubt expressed in the earlier description of this manus as to the presence of terminal phalanges and a claw upon the first digit still remains; the proximal phalanx associated with Mtc. I indicates that the terminal phalanx was missing.

Measurements.

	Morosaurus. mm.	*Camarasaurus, type.* mm.
Scapulo-coracoid, total length	910	2060
Coracoid, breadth opposite glenoid border	400	760
Humerus, total length	770	
Ulna, total length	560	
Radius, " "	550	
Scapho-lunar, transverse	120	
Mtc. I, length	205	
Mtc. II, "	250	
Mtc. III, "	250	
Mtc. IV, "	225	
Mtc. V, "	205	

CARPALS OF SUPPOSED MOROSAURUS, NO. 462.

These are especially interesting and valuable because of the absence of crushing, which gives the rounded or radial disposition of these bones as seen from above and in front (Fig. 5).

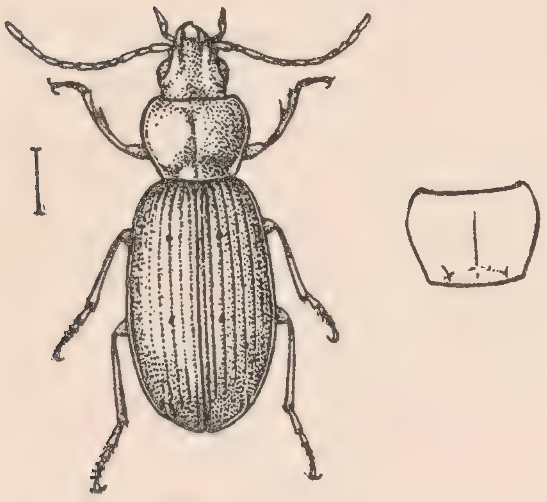
Measurements.

	mm.
Mtc. I, length	191
Mtc. II, "	218
Mtc. III, "	219
Mtc. IV, "	209
Mtc. V, "	186

The lateral metacarpals, I, V, have a more flattened section, the median metacarpals II, III, IV, present a more rounded section. Portions of the proximal and distal facets are well illustrated in the figure. As in *Diplodocus* the proximal facets decrease steadily in antero-posterior diameter as we pass from I to V. The posterior faces exhibit rugose areas for retractor tendons.

FORE LIMB OF BRONTOSAURUS, NO. 276.

In our collection are mounted two fore limbs of *Brontosaurus*, neither of which is complete. No. 276 is a young *Brontosaurus* carpus with which have been associated arbitrarily No. 318, ulna and radius, with extensive restoration. The carpals, as compared with those of *Diplodocus*, Nos. 594, 588, or 380, above described, are shorter and more robust. The manus of No. 268 has already been described (Osborn, 1899, p. 171). The metacarpals attain a very considerable length, but also acquire robust proportions, which enable us to readily distinguish them from those of *Diplodocus*; the placing of these elements is, however, somewhat conjectural. With the carpus is found the supposed scapho-lunar and three ossicles, which probably represent the carpals of the second row.



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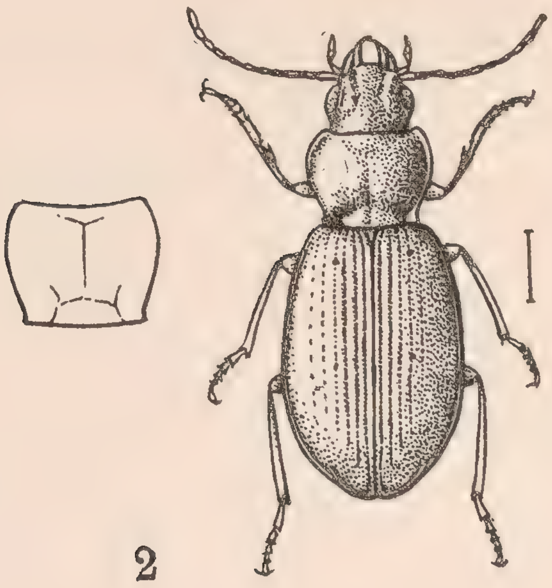

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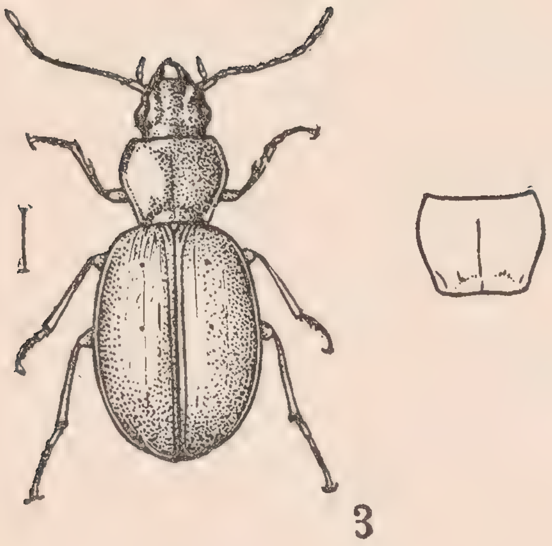

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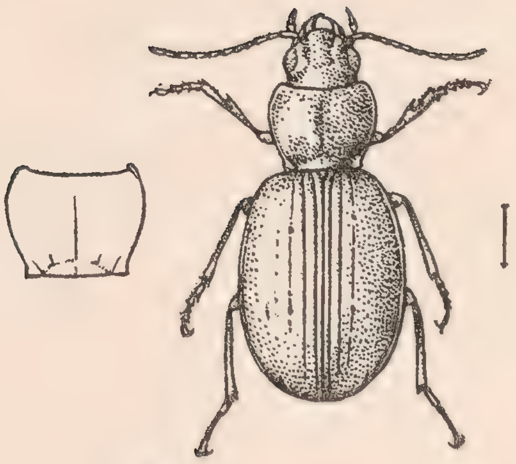

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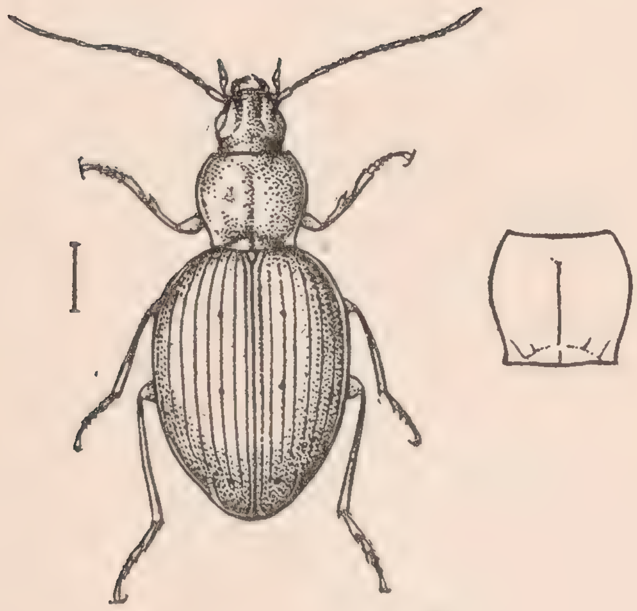

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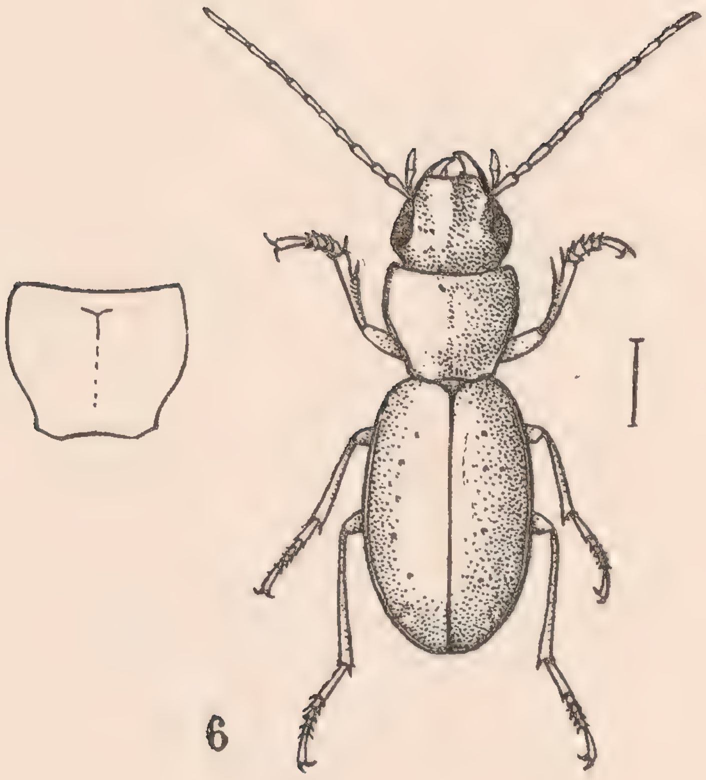

6

F. L. Hyatt.

1. Trechus rubens.
2. " chalybeus.
3. " ovipennis.
4. Trechus hydropicus.
5. " carolinæ.
6. " barbaræ.

Article XIV.—SYNOPSIS OF THE SPECIES OF TRECHUS, WITH THE DESCRIPTION OF A NEW SPECIES.

By Charles Schaeffer.

Plate XXVIII.

The account of the characters of the species of *Trechus* given by Dr. Horn in the 'Transactions' of the American Entomological Society, Vol. V, p. 131, and in his synopsis in the 'Bulletin' of the Brooklyn Entomological Society, Vol. V, p. 48, having become antiquated by the species added since, the opportunity is here taken to present a new synoptic table, with a few notes and the description of a new species collected by Mr. Beutenmüller on Mount Mitchell in western North Carolina, July, 1900.

I am under obligations to Mr. Beutenmüller for the assistance given me in the preparation of this paper, to Dr. Van Dyke and Mr. Chas. Fuchs for the loan and gift of specimens, and to Dr. Henry Skinner and Mr. S. Henshaw for aiding me in the bibliography of *Trechus chalybeus.*

Synoptic Table of the Species of Trechus.

Elytra without any trace of striæ, frontal impressions broad, very shallow.

  Sides of thorax very feebly arcuate in front, sinuate posteriorly, base oblique each side, lateral margin very narrow, not wider at base, elytra elongate.......................................*barbaræ.*

Elytra striate, striæ distinctly punctured, frontal impressions deep; form elongate or oblong oval.

  Side margin of thorax not sinuate before the hind angles, which are slightly obtuse; elytra twice as long as wide, with six deeply impressed and very distinctly punctured striæ...........................*rubens.*

  Side margin of thorax feebly sinuate before the hind angles, which are slightly prominent; elytra oblong oval, with usually five distinct, but more feebly punctured striæ...........................*chalybeus.*

Elytra striate, striæ almost impunctured, frontal impressions deep. Elytra broadly oval.

  Larger, base of thorax feebly oblique each side; elytral striæ usually obsolete; hind tarsi as long as the tibiæ....................*ovipennis.*

  Smaller, base of thorax truncate, hind angles distinct, elytra more convex, with usually the first two or three striæ deeply impressed; hind tarsi distinctly shorter than the tibiæ ....*hydropicus.*

Elytra ovate, with seven striæ, the outer ones more faintly impressed; side margin of thorax sinuate before the hind angles, which are prominent and rectangular; eyes smaller than in the other species, antennal joints more slender.. *carolinæ.*

Trechus barbaræ *Horn.*

Trechus barbaræ HORN, Trans. Am. Ent. Soc. Vol. XIX, 1892, p. 41.

As remarked by Dr. Horn, this species differs from all others by the entire absence of striæ on the elytra, the different form of thorax with the side margin narrow, not wider at base, and the very shallow frontal grooves. The five or six dorsal punctures on each elytron of the specimen before me are very likely abnormal, as Dr. Horn stated them to be "as usual."

Length, 4.5–5 mm.

Sta. Barbara, California.

Through the kind intercession of Dr. Van Dyke, I am indebted to Mr. Chas. Fuchs for the loan of a specimen of this interesting species.

Trechus rubens (*Fabr.*).

Carabus rubens FABRICIUS, Ent. Syst. Vol. I, 1792, p. 140; HORN, Trans. Am. Ent. Soc. Vol. V, 1875, p. 131 (characters); Bull. Brooklyn Ent. Soc. Vol. V, 1882, p. 48 (synoptic table).

Closely related to *T. chalybeus* Dej., from which it may be distinguished by the more elongate elytra, with seven more deeply impressed and very distinctly punctured striæ, and the obtuse and not prominent hind angles of the prothorax. By a slip of the pen Dr. Horn stated the elytra to be "twice as wide as long," which of course should read: elytra twice as long as wide.

Length, 4 mm.

Nova Scotia, Vermont; also Europe.

Trechus chalybeus *Dejean.*

Trechus chalybeus DEJEAN, Spec. Gen. Coleopt. Vol. V, 1831, p. 17; MANNERHEIM, Bull. Soc. Imp. Soc. Nat. Moscow, Vol. XVI, 1843, p. 215; HORN, Trans. Am. Ent. Soc. Vol. V, 1875, p. 131; Bull. Brooklyn Ent. Soc. Vol. V, 1882, p. 48.

Trechus californicus MOTSCHULSKY, Bull. Imp. Soc. Nat. Moscow, Vol. XVIII, pt. 4, 1845, p. 347.

Trechus micans LECONTE, Ann. Lyc. Nat. Hist. N. Y. Vol. IV, 1848, p. 414.

Trechus fulvus LECONTE, Ann. Lyc. Nat. Hist. N. Y. 1848, p. 415.

The more prominent eyes, the broader, less elongate elytra with usually five less deeply punctured and impressed striæ will readily separate this species from *T. rubens* Fabr. The penultimate joint of the maxillary palpi is equal to the last in this species, while *T. rubens* Fabr. has the penultimate joint distinctly shorter than the last. The sinuation of the side margin of thorax before the hind angles is in some specimens more distinct than in others.

Alaska, Br. Col., Cal., Oreg., Col., Lake Sup., N. H., N. J.

This species is credited in our lists to Mannerheim, but as his description is twelve years later than Dejean's, the latter must be given credit for this species, as is done in the Catalogus Coleopterorum by Gemminger & Harold.

Trechus ovipennis *Motsch.*

Trechus ovipennis MOTSCHULSKY, Bull. Soc. Imp. Nat. Moscow, Vol. XVIII, pt. 4, 1845, p. 348; HORN, Trans. Am. Ent. Soc. Vol. V, 1875, p. 131 (characters); HORN, Bull. Brooklyn, Ent. Soc. Vol. V, 1882, p. 48 (synoptic table).

Trechus lævigatus LECONTE, Smiths. Misc. Coll. Vol. VI, 1863–66, p. 14.

Larger than *hydropicus* with the first two or three striæ of the elytra never as deeply impressed as in that species and with the tarsi of the posterior legs as long as the tibiæ. The elytra are more regularly oval, although in one specimen kindly sent me by Dr. Van Dyke, supposed to be new, the elytra are broader at base with the sides not as broadly rounded as usual, which gives the insect a different appearance, but as I am unable to find a more tangible character to support this view, and as similar variations are seen in a large series of *hydropicus*, I consider this an individual variation.

Length, 4 mm.

California.

Trechus hydropicus *Horn.*

Trechus hydropicus HORN, Trans. Am. Ent. Soc. Vol. X, 1883, p. 273.

Usually much smaller than any other species of the genus; only a very few specimens of a large number before me, all collected by Mr. Beutenmüller in North Carolina, are nearly as large as *ovipennis*. The first two or three striæ of the elytra are always distinctly impressed and the outer ones very obsolete, though specimens occasionally occur with four or even five distinct striæ, and in one the striæ are nearly as obsolete as in *T. ovipennis* Motsch., but these are rare exceptions, judging from the series of about one hundred specimens before me. A very few specimens, usually the larger ones, have the side margin of thorax slightly sinuate before the hind angles, which become thus somewhat prominent, as seen in Plate XXVIII, Fig. 4. The tarsi of the posterior legs are distinctly shorter than the tibiæ. The antennæ are described as pale; while this is the case in a few specimens, the majority have the outer joints darker than the first two or three.

Length, 2.75–3.75 mm.

Virginia, Western North Carolina.

Trechus carolinæ sp. nov.

Ferruginous, shining, antennæ and legs paler. Frontal impressions deep, eyes small. Thorax wider than long, apex and base equal, sides arcuate anteriorly, sinuate posteriorly, hind angles prominent, rectangular, lateral margin wider posteriorly, median line distinct. Elytra ovate, convex, about one third longer than wide, surface smooth, with seven striæ, the outer ones more faintly impressed. Body beneath smooth and shining.

Length, 4.25 mm.

This species differs from all our others by the ovate and more convex elytra, with seven almost impunctate striæ, only the sutural striæ is very obsoletely punctate, visible only with a strong lens, the different form of thorax with base and apex equal in width, the smaller eyes and the comparatively more slender and longer joints of the antennæ.

For this interesting addition to our fauna we are indebted to Mr. Beutenmüller, who obtained our specimen by sifting moss on Mt. Mitchell in North Carolina, in July, 1900.

EXPLANATION OF PLATE.

Fig. 1. *Trechus rubens* Fabr., and prothorax, very much enlarged.
" 2. " *chalybeus* Dej. " " " " "
" 3. " *ovipennis* Motsch., and " " " "
" 4. " *hydropicus* Horn, and " " " "
" 5. " *carolinæ*, sp. n. " " " " "
" 6. " *barbaræ* Horn " " " " "

Article XV.—DESCRIPTIONS OF TWO NEW OPOSSUMS OF THE GENUS METACHIRUS.

By J. A. ALLEN.

The Opossums of the genus *Metachirus* of Mexico and Central America had been referred to *D. quica* of Temminck, the type locality of which is the coast region of southeastern Brazil (*cf.* Allen, this Bulletin, XIII, 1900, p. 195), until in October of last year I separated the Central American form as *Metachirus fuscogriseus* (*l. c.*, p. 194), on the basis of a specimen supposed to have come from Colon. Through the kindness of Dr. C. Hart Merriam, Chief of the Biological Survey, U. S. Department of Agriculture, I have recently had opportunity to examine large series of specimens from Nicaragua and various localities in Mexico, numbering altogether 42 specimens. As probably no large series of examples of the genus *Metachirus* has ever before been brought together, it seems desirable to give a somewhat detailed account of this important collection.

Metachirus fuscogriseus *Allen*.

Metachirus fuscogriseus ALLEN, Bull. Am. Mus. Nat. Hist., XIII, 1900, p. 194.

A number of specimens from Greytown and Bluefields, Nicaragua, agree well with the type of this species, supposed to have come from a point somewhat further south on the coast. There is, therefore, little to add to the original description of the species beyond noting the variations in the specimens of the present series due to age, season, etc.

The present material consists of 4 specimens, two adult males and two adult females, collected at Greytown, Feb. 7–10, 1892, by Dr. C. W. Richmond, now Assistant Curator of Birds at the U. S. National Museum ; and 3 adults, 3 young adults, and 5 half-grown young, collected 50 miles above Bluefields on the Escondido River at various dates from May to November of the same year, also by Dr. Richmond, making in all 15 specimens from these two localities.

Three of the Greytown specimens are quite uniform in coloration, while the fourth is of a duller, browner black above and more strongly buffy below. The Bluefields adult and young adult specimens are similar in coloration to those from Greytown, except in the case of one very old male, distinguished by its large size and a strong orange-rufous tinge on the cheeks, sides of the neck, and throat. This series shows, as in the case of *Didelphis*, that the animal increases greatly in size after reaching maturity. In the younger specimens the buff color of the ventral surface is restricted to the chest and the lower abdominal region, the two areas being connected by a narrow buffy median band, the sides of the abdomen being more or less plumbeous, with the tips of the hairs lighter, a condition often seen in various species of Muridæ, especially in *Neotoma*, *Oryzomys* and allied genera. The adult males are distinguished in the breeding season by a pale yellowish patch on the sides of the lower abdomen just in front of the thighs, the corresponding area in the female being whitish, and the hair at these points is of a little different texture from that of the surrounding parts.

EXTERNAL MEASUREMENTS.

Nat. Mus. No.	LOCALITY.	Sex.	Total length.	Head and body.	Tail.	Tarsus.	Tail ratio.
33139/45143	Greytown, Nicaragua	♂	586	282	304	45	108
33138/45142	" "	♂	530	257	273	40	107
33140/45144	" "	♀	529	261	268	41.5	103
33141/45145	" "	♀	519	245	274	40	112
36485/51442	Near Bluefields,[1] Nicaragua	♂	625	305	320	46	105
50877	" " "	♀	562	265	297	41	113
51380	" " "	♀	518	243	275	41	113
	Average, 3 males		580	281	299	44	106
	" 4 females		532	254	279	41	109.8

[1] Fifty miles from Bluefields, on the Escondido River.

MEASUREMENTS OF SKULLS.

Mus. No.	LOCALITY.	Sex.	Total length.	Basal length.	Nasals.			Zyg. breadth.	Postorb. proc.	Postorb. constr.	Mastoid breadth.	Palate.		Upper toothrow.	Molar series.
					Length.	Gr. breadth.	Least br'dth.					Length.	Br'dth at m^4 outside.		
45143/33139	Greytown, Nicaragua	♂	77.3	65	34.6	9	5	38.5	14.3	9	23	40	21.4	26	14
45144/33140	" "	♀	66	61	32.3	8	4	34.5	14.5	9	21.5	39	20	25	14
50887	Bluefields, "	♀	66	60	33.5	6	5	33	12	9	18.5	38	20	25.3	13.6
51442	" "	♂	79	70	36	9	5.6	40.5	15	8.3	24	43	22	25	14

Metachirus fuscogriseus pallidus, subsp. nov.

Type, No. 58158, U. S. Nat. Mus., ♂ adult, Orizaba, Vera Cruz, Mexico, June 24, 1894. Collected by E. W. Nelson and E. A. Goldman.

Similar to *M. fuscogriseus*, but the coloration is much lighter, the eye spots are larger, and the black of the head less intense and more restricted in area posteriorly; size and proportions apparently the same as in *fuscogriseus.*

Measurements.—Type: Total length, 627; head and body, 315; tail, 312; tarsus, 47 (collector's measurements in the flesh). The skin measurements show different proportions. While the total length is the same as above given, the length of the head and body is 310, and of the tail 317, which would give about the normal tail ratio. For further measurements see table of measurements below.

Skull.—The skull presents no appreciable difference from skulls of corresponding age of *M. fuscogriseus* from Nicaragua. The measurements of the type skull are as follows: Total length, 77; basal length,[1] 69; length of nasals, 37; zygomatic breadth, 39; postorbital processes, 14.3; postorbital constriction, 9; mastoid breadth, 25; palatal length, 42; palatal breadth at mm$\underline{4}$ (including teeth), 22.5; upper toothrow, 27; upper molar series, 15. The specimen selected for type is much above average size, as shown by the measurements tabulated below.

EXTERNAL MEASUREMENTS.

Nat. Mus. No.	LOCALITY.	Sex.	Total Length.	Head and body.	Tail.	Tarsus.	Tail ratio.
100189	Montecristo, Tabasco, Mex.	♂	555	267	288	44.5	108
100028	Frontera, “ “	♂	556	265	291	46	110
100027	“ “ “	♀	508	254	254	43.5	100
100034	Teapa, “ “	♂	585	275	310	47	111
100031	“ “ “	♂	582	280	302	47	107
100033	“ “ “	♀	542	253	289	43.5	110
100032	“ “ “	♀	542	254	288	41.5	112
100030	“ “ “	♀	505	241	264	41	109.5
100029	“ “ “	♀	558	265	293	43	110
77908	Huehuetan, Chiapas, “	♂	545	264	281	46	106
78003	Chicharras, “ “	♀	524	254	270	43	106
58158	Orizaba, Vera Cruz, “	♂	627	315	312	47	99
58157	“ “ “	♀	490	250	240	38	96
63664	Montzorongo, “ “	♀	488	220	260	40	118
65403	Tuxtepec, Orizaba, “	♂	580	265	315	46	119
65404	“ “ “	♂	580	280	300	45	107
92992	Metlaltoyuca, Puebla, “	♂	517	240	277	43	115.4
92993	“ “ “	♂	527	245	282	44	115
92994	“ “ “	♂	578	298	280	48	94
92995	“ “ “	♂	585	283	302	46	106.7
92991	“ “ “	♀	475	222	253	40	114
Average	Teapa, etc., Tabasco,	4 ♂ ♂	569.5	272	298	46	109
	“ “	5 ♀ ♀	535	254	277.6	42.5	108.3
	Tuxtepec, Orizaba,	2 ♂ ♂	580	272.5	307.5	45.5	113
	Metlaltoyuca, Puebla,	4 ♂ ♂	551.5	266.5	285	45.2	110.3

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[1] From posterior base of incisors to front border of foramen magnum.

MEASUREMENTS OF SKULLS.

Nat. Mus. No.	LOCALITY.	Sex.	Total length.	Basal length.	NASALS.			Zygom. br'dth.	Postorb. proc.	Postorb. constr.	Mastoid br'dth.	PALATE.		Upper toothrow.	Molar series.
					Length.	Gr. br'dth.	Least br'dth.					Length.	Br'dth at m ^{4}, outside.		
58156	Orizaba, Vera Cruz, Mex.	♂	74	62	36	8	5	32.5	13	9	24	40	21	25	14
58158	" " "	♂	77	69	37	9.3	5	39	14.3	9	25	42	22.5	27	15
63663	Chichicaxtle, " "	♂	71.3	65.5	34	8	4.5	38	14	8.5	22.3	40	20.7	25	13.5
65405	Catemaco, " "	♀	73	67	34	8	4.3	37	13.5	8.5	22.5	40	21	26	14.3
63664	Motzorongo, " "	♀	60	55	28	7	3.5	30	10.5	8.5	18	35	18.5	23.3	13
93001	Papantla, " "	♂	64	57.5	30	7	4.5	32	11.3	8.6	19	36	19.5	25	14
93002	" " "	♂	64.5	57.5	30	6.6	4	31.5	11.3	8.5	19	36	19.5	24	13.3
65404	Tuxtepec, Oaxaca, "	♂	69	61.5	32	7.6	4	34	12.5	8.3	21	38	21	25.3	14
77908	Huehuetan, Chiapas, "	♂	69	61.7	32	7.3	4	35	12.7	8.2	20	39	20	25.5	14
78003	Chicharras, " "	♀	67	59	33	7.5	4.2	32.2	11.3	8.4	20	38	19	24	13.5
92991	Metlaltoyuca, Puebla "	♀	61	54	27	7	3.4	30	10	8	18.2	34	19	23	13
92992	" " "	♂	62	57	30.2	7.5	4	33	11.2	8.7	19.5	36	20	23.5	13
92993	" " "	♂	61.6	60	30	6.5	4	32	10.5	8.2	20	38	20	24.6	13.5
92994	" " "	♂	74.3	68	35	8.2	5.4	41	16	9	23	41	21	24	13
92995	" " "	♂	69	63.5	33	7	4	35.5	12	8.5	22	39	21	25	13
100027	Frontera, Tabasco, "	♀	66.3	61	32.2	8	4.3	33	12	8.5	20	38	20	25	14
100030	Teapa, " "	♀	64.5	59	29	7	4	32.3	11.4	8	20	37.3	20	25	13.6
100032	" " "	♀	63	57.5	30.5	7.2	4	32	11.2	8	19.5	36	19.7	24	13.2
100033	" " "	♀	64	58.4	30.2	7	4	33	10.7	8.2	19.5	36	20.3	25	13
100031	" " "	♂	74.5	67.5	35.5	8	5	38	13	8	22	41	21	26	14.2
100028	Frontera, " "	♂	70	63	35	7.3	4.3	35	12.5	7	21	39.5	20	25.5	14

This pale northern form of *Metachīrus fuscogriseus* is represented by a considerable number of specimens from the States of Tabasco, Vera Cruz, Oaxaca, and Puebla. They vary a little in coloration above, some being darker than others, but the difference is slight and partly seasonal. The lower surface varies in general tone from yellowish white to deep buffy white. Young specimens show gray areas on the sides of the abdomen, as in *M. fuscogriseus.* All the adult males show more or less strongly a sulphur yellow patch on the sides of the abdomen in front of the thighs, this tint varying from pale yellowish to strong greenish yellow. Several specimens differ from the average style through the intensity of the buff coloration on the throat and sides of the neck, which tint sometimes prevails as a strong buff wash over most of the lower surface. The greenish yellow patch in front of the thighs is characterized by a slightly different texture of the hair, and is represented in the female by a clearer white than the surrounding parts. Apparently it is a glandular area, and most active in the breeding season, corresponding doubtless to the glandular area on the lower throat and chest in *Didelphis.*

As shown in the tables of measurements, there is considerable variation in size, and some in proportions, in animals that have reached maturity, measurements being given of no specimens in which the last molar has not come into use, with other evidences of maturity. The largest specimen, which has perhaps unfortunately been taken for the type, is equalled in size by a single specimen from Greytown, also an old male. The ratio of length of tail to length of head and body varies in specimens from the same locality, as at Metlaltoyuca, Puebla, from 94 to 115, with a total range of variation in this respect from 94 to 119, the average being 109. In young and middle-aged skulls there is barely a trace of a sagittal crest, but in old males it attains a height of 2 to 3 mm. The postorbial processes are but slightly developed in early life, reaching only a moderate development even in old age. The postorbital constriction is much less than in the allied genus *Didelphis*, to which in many respects the skull is closely similar. The nasals, however, are more pointed, both posteriorly and anteriorly, terminating at both extremities in attenuated points. The large series from Teapa and Frontera, Tabasco, appear not to show any average difference, either in coloration or size, from specimens from Metlaltoyuca, Puebla, and further subdivision of the material seems at present unnecessary.

Metachirus grisescens, sp. nov.

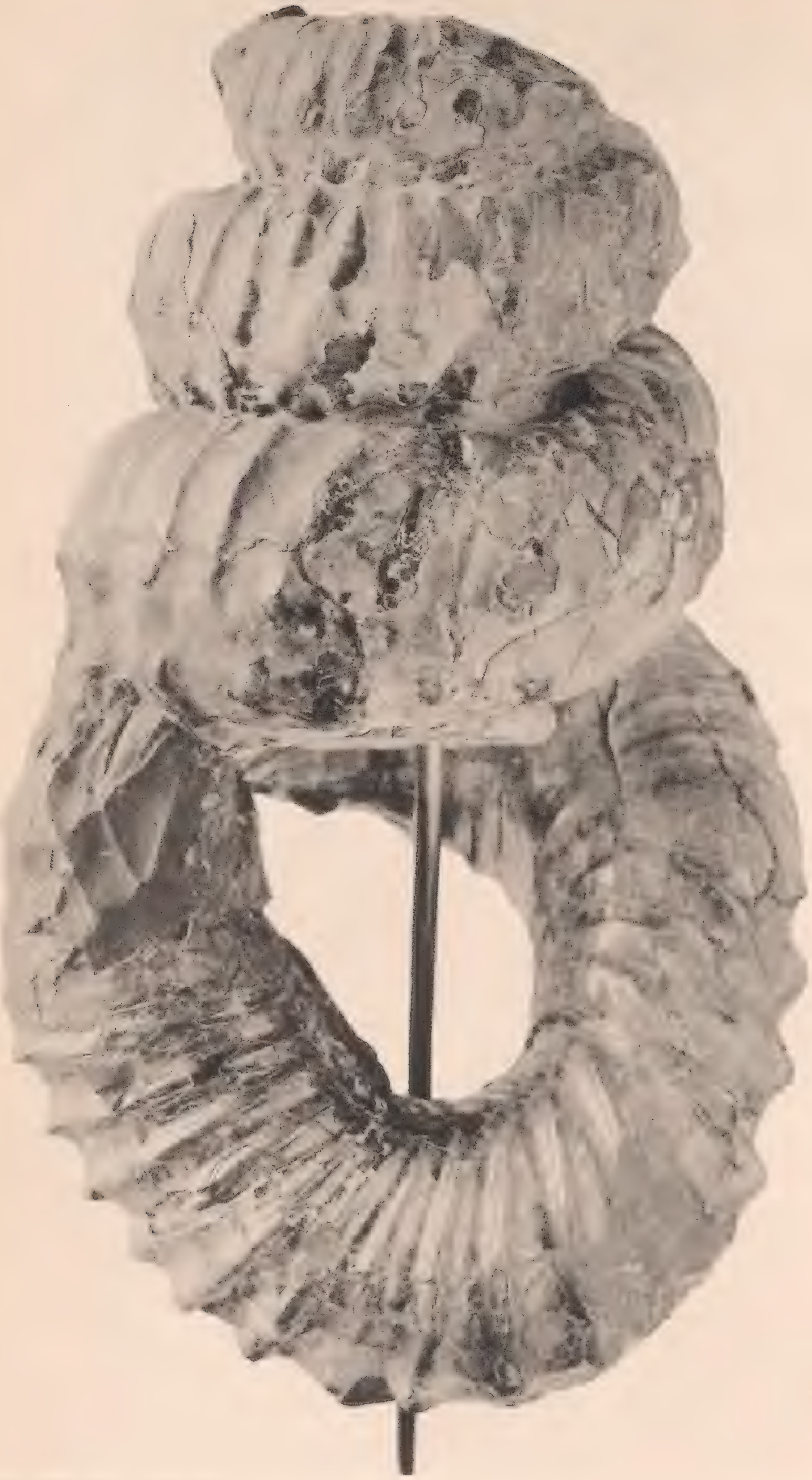
Type, No. 15072, Am. Mus. Nat. Hist., ♀ adult, Rio Cauca, Colombia, June, 1899; J. H. Batty.

Somewhat similar to *Metachirus fuscogriseus pallidus*, but much paler throughout with the tail uniform dark brown, not light at the tip as in the *M. fuscogriseus* group. General coloration above gray, varied with black; below whitish, with a slight buffy suffusion; eye spots and head markings as in *M. fuscogriseus*, the black, however, less intense, and much less extended posteriorly. While the general coloration above is blackish varied with gray in *M. fuscogriseus*, in the present species it is gray varied with blackish.

Measurements (from the dried skin).—Total length, 510; head and body, 260; tail, 240; tarsus, 38; tail ratio, about 91. These measurements are only approximate, as the tail is not wholly filled out and the specimen is not well prepared, the skin evidently being much shrunken. The ears are small, about 20 by 17 mm. in the dry skin.

Skull.—The skull differs from that of *Metachirus fuscogriseus* in the great expansion of the posterior portion of the nasals, which maintain a uniform breadth for about 4 mm. beyond the point of greatest expansion, then taper suddenly and end abruptly, instead of converging evenly to a slender point. The palatal vacuities are also unusually developed, as much so as is ordinarily the case in *Didelphis.* The skull is large for the size of the skin, which is sexed by the collector as a female. Total length, 68; basal length, 62; length of nasals, 33; zygomatic breadth, 36; postorbital processes, 15; postorbital constriction, 9; mastoid breadth, 37.6; breadth across mm $^{\underline{4}}$, 19.5; length of upper toothrow, 23; upper molar series, 13.

This species is based on a single specimen from Rio Cauca, Colombia, collected by Mr. J. H. Batty, June, 1899. It differs from the Mexican and Central American forms in its very light coloration and in the tail being uniformly blackish brown without the usual light tip. The skull is peculiar for a member of this genus in the large size of the palatal vacuities and in the great breadth of the posterior third of the nasals, which have more the form of the nasals in *M. nudicaudatus.* It differs, however, from this species through its much larger size and different coloration, and in the basal two inches of the tail being furred.



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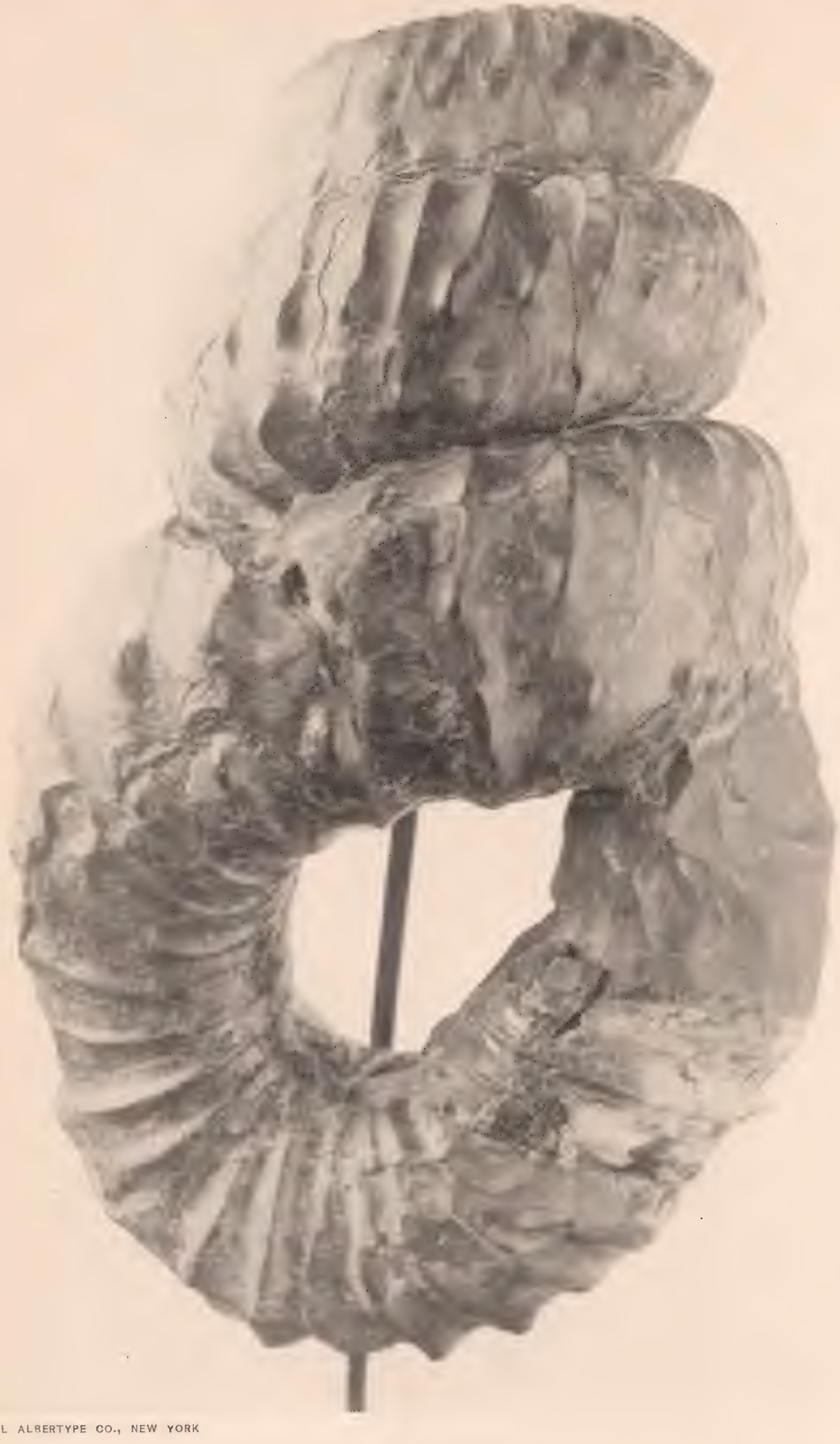
HELICOCERAS STEVENSONI, N. SP.
Front View, Nat. Size.



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Helicoceras stevensoni, n. sp.
Back view, Nat. Size.

Article XVI.—NOTE ON A VERY FINE EXAMPLE OF HELICOCERAS STEVENSONI PRESERVING THE OUTER CHAMBER.

By R. P. Whitfield.

Plates XXIX and XXX.

In the volume on the Geology of the Black Hills published by the United States Department of the Interior in 1880, p. 447, and in a previous Preliminary Report on the Palæontology of the Black Hills, I published an imperfect specimen of *Helicoceras stevensoni*, the best then to be obtained. Some years later the Museum obtained by purchase a much better individual containing about four volutions, but still imperfect at both ends. Recently the Museum has purchased a large specimen of the species which retains nearly the three lower whorls and the deflected lower chamber, or chamber of habitation, which is deflected obliquely downward from the back of the lower whorl to the distance of about three inches. Then it bends sideways across and below the umbilicus and recurves upward to within an inch, on one side of the aperture, and an inch and a quarter on the other of the underside of the last regularly coiled volution.

There are no visible signs of septa beyond the half of the last regularly coiled volution ; the outer half of this volution and all of the deflected part representing the chamber of habitation. On the deflected part there are no signs of what are usually called "old-age characters," such as more close arrangement of the ribs, or dying out of nodes ; but the usual features are retained.

The specimen is highly interesting as being the most complete in the outer chamber of any known, although the upper coils are absent.

The specimen came from the Fort Pierre group of the Cretaceous, at Chadron, Nebraska.

EXPLANATION OF PLATE XXIX.

Helicoceras stevensoni Whitf. p. 220. View of the front side of the specimen, natural size.

EXPLANATION OF PLATE XXX.

Helicoceras stevensoni Whitf. p. 220. View of the back of the specimen described, natural size.

Article XVII.—NOTICE OF A REMARKABLE CASE OF COMBINATION BETWEEN TWO DIFFERENT GENERA OF LIVING CORALS.

By R. P. Whitfield.

Plates XXXI and XXXII.

While examining living corals around Nassau, N. P., in March of this year (1901), I noticed a very pretty specimen of *Meandrina labyrinthica* in about three fathoms of water, off Green Key, twelve miles east of the city, which appeared to have a peculiar blemish on the top of the dome. On bringing the coral up to the surface, it was found that the centre of the dome inclosed a specimen of an entirely different coral. In cleaning the specimen it was found that the central part consisted of a small individual of a species of *Ctenophyllia* and that the *Meandrina* was very intimately blended with it; so intimately, indeed, that three of the ridges of the *Meandrina* passed directly into and united with the adjoining ones of the *Ctenophyllia*. When collected, both species were alive, and in a very healthy and perfect condition.

Meandrina labyrinthica when alive is of a yellowish olive color, both at Nassau and around the Bermudas. The *Ctenophyllia* around Nassau, at least all the species which I have observed, have been of an ash gray or drab color, though some of them have the curtain which covers the channel and the polyp centres within it of a bright emerald green color; but in the case of this specimen both species presented the yellowish olive color peculiar to the *Meandrina*.

When the coral was first taken from the water, and before it was cleaned, I thought it probable that the imbedded specimen was a specimen of *Manicina areolata*, as given by Dana in the Zoöphytes of the U. S. Expl. Exped.; but as soon as the water was expelled by the shrinkage of the polyps, this view was discarded.

The specimen of *Ctenophyllia* does not correspond closely with any of the species elsewhere found around Nassau, or with any of those described or figured by Dana, well enough to be specifically identified with them. It is perhaps nearest to *Ctenophyllia* *quadrata* Dana, but the channels are narrower, and the lamellæ finer and more closely arranged, scarcely grooved at the summit, and their edges similarly denticulate. The spongy matter of the polyp cells in the channels partakes, on the side next to the *Meandrina* side of the ridge, of the characters of the *Meandrina*, but where the cells join with the lamellæ of the *Ctenophyllia* they are more like those further within the area of the inclosed *Ctenophyllia*.

The figures given to illustrate this peculiar specimen, which is preserved in the collection of the American Museum of Natural History, are from photographs direct from the specimen.

The fact is so remarkable that it has been thought worthy of special notice, as something so entirely unusual in nature. It seems even more so because the individual was not living on a reef crowded with many other forms, where individuals are liable through accident to become displaced and dropped upon other and distinct forms, but was out in a clear space on a sand-and-rock bottom, entirely isolated from surrounding material.

EXPLANATION OF PLATE XXXI.

The figure shows the specimen of *Meandrina labyrinthica* with the example of *Ctenophyllia* in the centre, one half natural size. Facing page 222.

EXPLANATION OF PLATE XXXII.

The figure shows the *Meandrina* inclosing the *Ctenophyllia*, natural size. The ridges of the *Meandrina* can be seen blending into those of the *Ctenophyllia*, one at the lower right side and two others on the upper left side. The figures are from photographs.

Article XVIII.—SOME OBSERVATIONS ON CORALS FROM THE BAHAMAS, WITH DESCRIPTION OF A NEW SPECIES.

By R. P. Whitfield.

Plates XXXIII and XXXIV.

Among the corals found around Nassau, N. P., and also in the waters about Bermuda, there are quite a number for which as yet we can find no name. Among them is one form of *Diploria*, which certainly is distinct enough to be classed under a name different from either *Diploria cerebriformis* (*Meandrina cerebriformis* Dana) or *Diploria stokesi*, as it occurs not uncommonly both around the Bermudas near the North Rocks, and all about Nassau, N. P., Bahamas, both in the harbor and in the vicinity of the keys, more especially east of the city. It is characterized by the gyrations forming a series of geometrical figures, often resembling somewhat the figures known as the 'Walls of Troy' or the Grecian vine, Greek border or Key border or Greek fretwork, a form of ornamentation much used in embroidery and other places as a bordering, an angularly convolute figure. For convenience in our own collection here in the Museum I propose to name this species

Diploria geographica, n. sp.

Plates XXXIII and XXXIV.

Colonies massive, growing in hemispherical form; ridges between the rows of corallites double, rather deeply channeled; lamellæ fine, fifteen to sixteen in the space of one centimetre, sharply dentate on the edges and often more coarsely so within the channel; polyp-channel nearly as wide as the double ridge, the sides of the ridges slightly concave; gyrations very tortuous but distinctly in geometric patterns, resembling somewhat the angularly convolute figure known as the 'Walls of Troy,' 'Grecian vine,' etc.

Color, when living, usually yellowish olive through the surface.

Habitat, West Indies, Bahamas, and around Bermuda. Probably common throughout the West Indies.

EXPLANATION OF PLATE XXXIII.

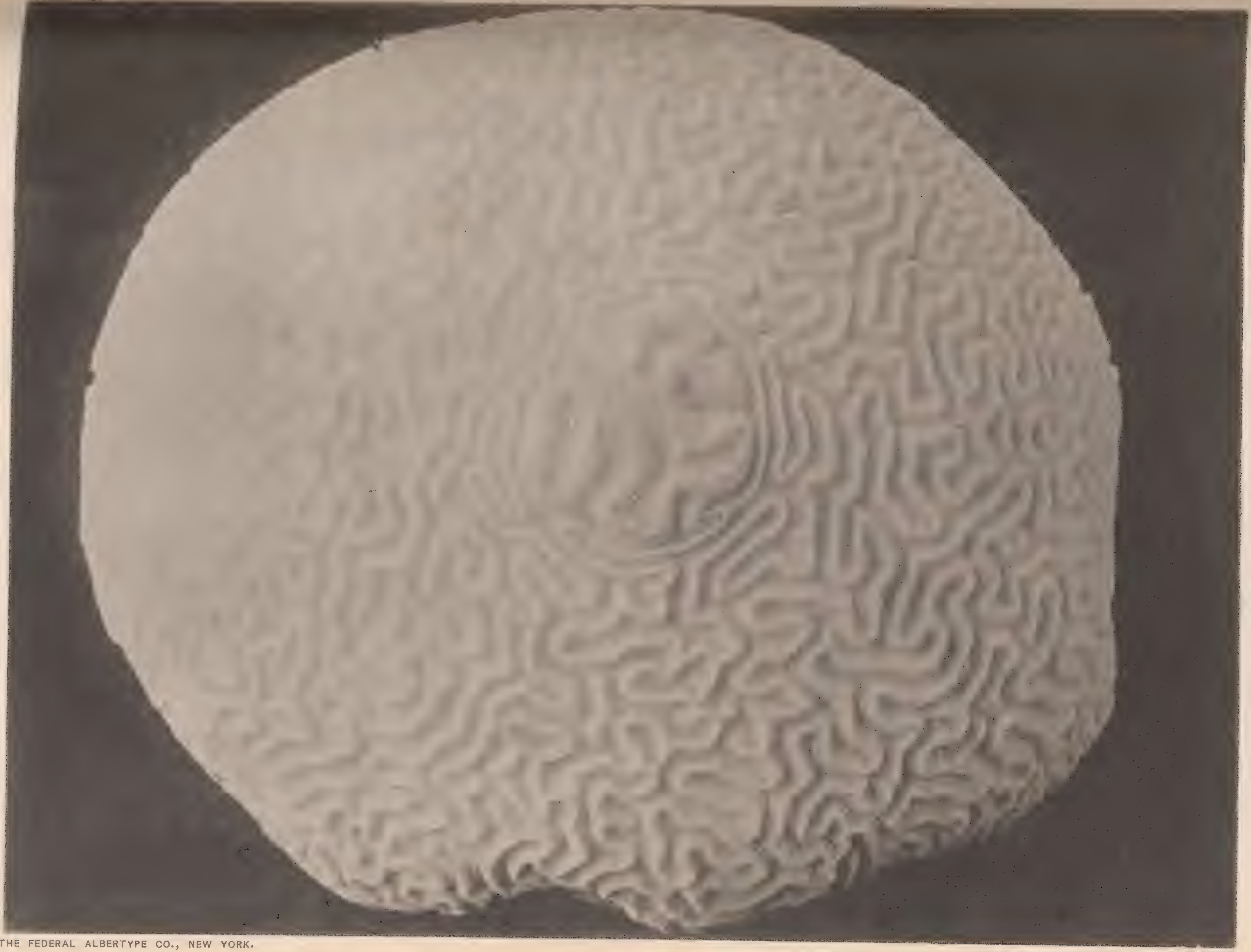
DIPLORIA GEOGRAPHICA, n. sp. Facing page 224.

The figure is a summit view of a specimen from near Nassau, N. P., Bahamas, a little less than one half natural size. It shows the angularly convolute contortions of the ridges fairly well. Made from a photograph.

EXPLANATION OF PLATE XXXIV.

DIPLORIA GEOGRAPHICA, n. sp. Facing page 224.

The figure is just one half natural size and presents a lateral view of the same specimen as the figure on Plate XXXIII.



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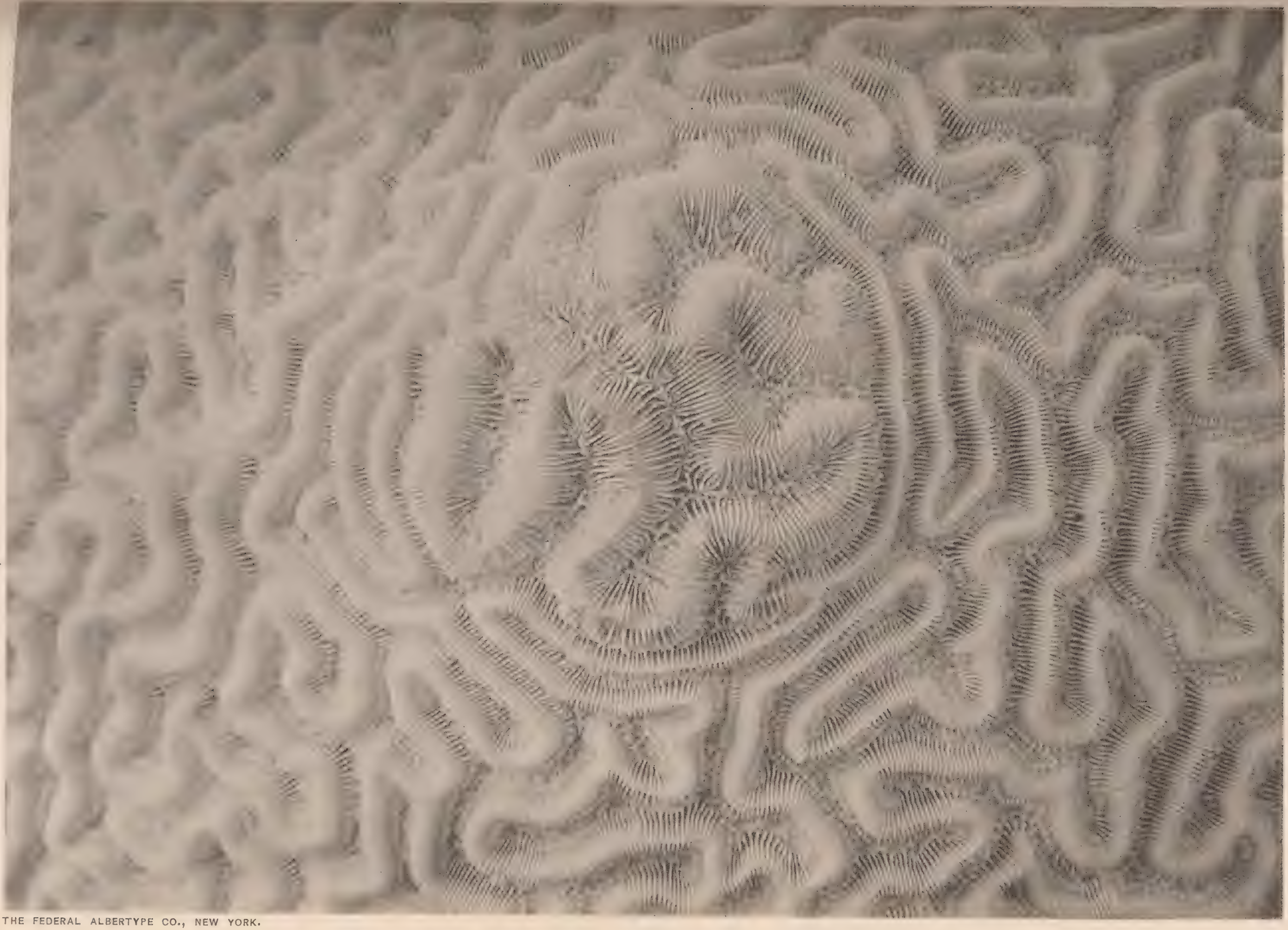
Meandrina labyrinthica, with Ctenophyllia inclosed.

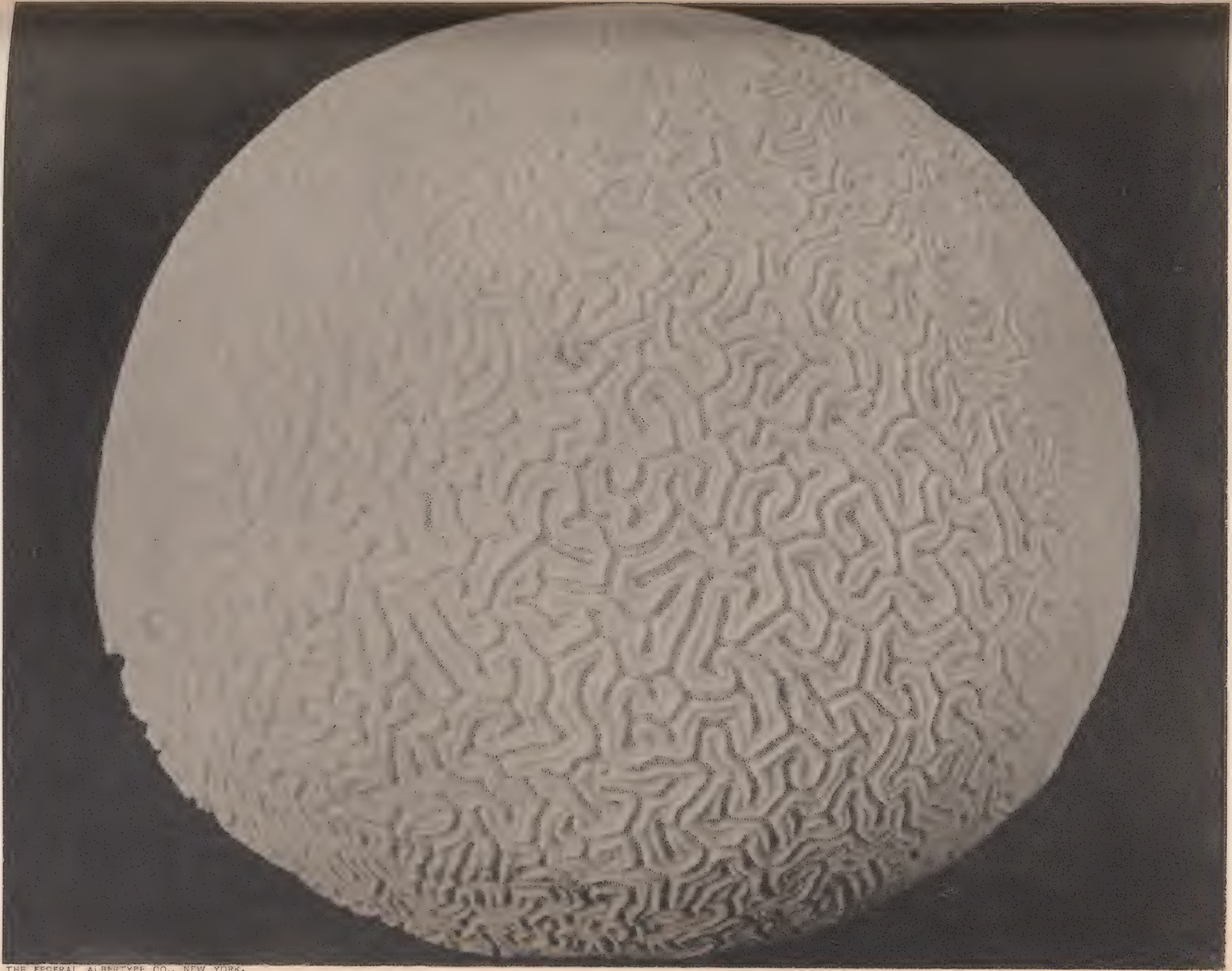
½ Nat. Size.



THE FEDERAL ALBERTYPE CO., NEW YORK.

MEANDRINA LABYRINTHICA, INCLOSING CTENOPHYLLIA.

Nat. Size.



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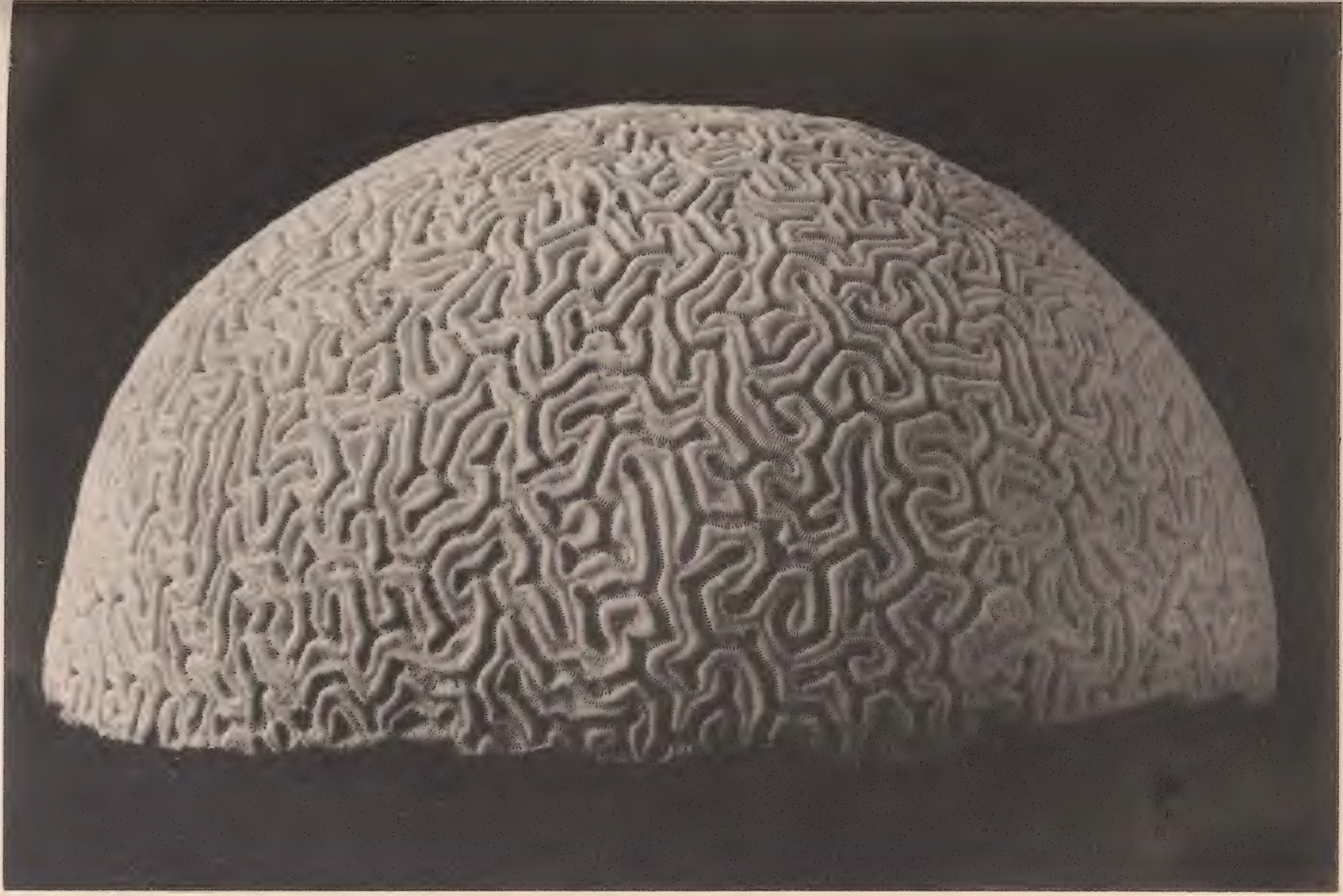
DIPLORIA GEOGRAPHICA, N. SP.

4-9 Nat. Size



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Diploria geographica, n. sp.

½ Nat. Size.

Article XIX. — DESCRIPTIONS OF SIX APPARENTLY NEW BIRDS FROM PERU.

By Frank M. Chapman.

A collection of about one hundred birds received early in the present year from Mr. H. H. Keays,[1] by whom it was made at Inca Mine, Southeastern Peru (latitude 13° 31′ S., longitude 70° W., altitude 6000 feet), contains, among such little known birds as *Mitrephanes olivaceus* Berl. & Stolz., *Synallaxsis griseiventris Allen*, and *Scytalopus analis bolivianus* Allen, examples of two apparently well-marked races and four remarkably distinct species all of which are described below.

Chlorochrysa fulgentissima, sp. nov.

Char. sp.—Most nearly related to *Chlorochrysa calliparæa* Tsch. but with the center of the crown yellow, neck patches and rump scarlet, lower back turquoise, throat, breast, and abdominal streak to the vent hyacinth-blue.

Description of Type (No. 72089, Am. Mus. Nat. Hist., ♂, Inca Mine, Peru, Dec. 5, 1899, H. H. Keays). — Upper parts shining grass-green, the feathers black basally; center of the crown with a small lemon-yellow spot; lower back turquoise, rump scarlet; rectrices and remiges black, edged externally with green which, apically, shows a tendency to become bluish; patches at sides of the neck scarlet; chin, throat, breast, abdomen medianly, and edge of the wing hyacinth-blue, sides of the breast and of the abdomen, the flanks and crissum shining grass-green.

Measurements.—Wing, 2.80; tail, 1.70; tarsus, .73; exposed culmen, .42 in.

Description of Female (No. 72087, Am. Mus. Nat. Hist., Inca Mine, Dec. 21, 1899, H. H. Keays). — Similar to the male, but duller, the yellow crown-patch absent, the rump and neck patches more orange.

Measurements.—Wing, 2.60; tail, 1.53; tarsus, .72; exposed culmen, .42 in.

Remarks.—Of this beautiful and surprisingly distinct tanager Mr. Keays sends three specimens, two males and a female. The males are essentially alike; the female differs from them as described above.

Malacothraupis castaneiceps, sp. nov.

Char. sp.—Differing from *Malacothraupis dentata* Scl. & Salv., the only described species of the genus, in being uniformly gray with the exception of the crown, which is chestnut.

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[1] See also papers by J. A. Allen on the mammals collected by Mr. Keays, this Bulletin, Vol. XIII, 1900, p. 219; XIV, 1901, p. 41.

Description of Type (No. 72093, Am. Mus. Nat. Hist., ♂, Inca Mine, Peru, Dec. 4, 1899, H. H. Keays). — Forehead gray, whole crown bright chestnut extending to the nape; rest of the upper parts, including the wings and tail, slate-color; under parts somewhat lighter, with, in places, a faint indication of transverse whitish markings.

Measurements.—Wing, 2.70; tail, 2.45; tarsus, .78; exposed culmen, .45 in.

Remarks. — The single specimen of this well-marked species contained in Mr. Keays' collection is referred to *Malacothraupis* after comparison with an adult male example of *Creurgops verticalis* and the figure of *Malacothraupis dentata* published, with the original description of this species, in the 'Proceedings of the Zoölogical Society' (1876, p. 353, Pl. XXXI) and again in the 'Catalogue of the British Museum' (Vol. XI, p. 216). It agrees with the latter in both size and form and differs, therefore, from *Creurgops* in being smaller with the bill weaker and the commissural notch proportionately less pronounced. These differences do not impress one as of generic value and the discovery of a species intermediate in size between the known forms might well be followed by the reduction of *Malacothraupis* to subgeneric rank.

Euphonia xanthogastra brunneifrons, subsp. nov.

Char. subsp. — Similar to *Euphonia xanthogastra* Sund. but size somewhat larger, the color of the crown much deeper.

Description of Type (No. 74058, Am. Mus. Nat. Hist., ♂, Inca Mine, Peru, June 25, 1900, H. H. Keays). — Crown rich raw sienna[1]; throat, sides of the head and nuchal region deep violet purple, changing to glossy blue-black on the back, rump, and external margins of the feathers of the tail and wings; under parts, except throat, gallstone-yellow,[1] the sides brighter, the middle of the abdomen buffy; outer pair of tail-feathers with a subterminal white patch on the inner web.

Measurements.—Wing, 2.60; tail, 1.52; tarsus, .65; exposed culmen, .30 in.

Remarks. — Comparison of the two adult males of this form with nine adult males of *xanthogastra* from Bahia, Quito, the Napo region, and Bogotà seems to warrant the separation here proposed. In *xanthogastra* there is little or no difference between the color of the crown and that of the under parts; in *brunneifrons*, on the contrary, the crown is markedly browner than the under parts.

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[1] *Cf.* Ridgway's 'Nomenclature of Colois.'

Chlorospingus flavigularis parvirostris, subsp. nov.

Char. subsp.—Similar to *Chlorospingus flavigularis* (Scl.) but upper parts, breast, and sides browner, wing shorter, bill smaller, the lores greenish yellow.

Description of Type (No. 74062, Am. Mus. Nat. Hist., ♂, Inca Mine, Peru, June 16, 1900, H. H. Keays).—Upper parts brownish olive-green, wings and tail fuscous, the feathers margined externally with the color of the back; lores greenish yellow; throat, chin, and crissum lemon-yellow, the latter slightly brownish; rest of the under parts grayish white, clearer on the middle of the belly, the breast and sides deeper and washed with pale broccoli brown; thighs broccoli brown.

Measurements.—Wing, 2.70; tail, 2.05; tarsus, .86; exposed culmen, .41; depth of bill at anterior margin of nostril, .19 in.

Remarks.—Comparison of two adults in the Keays collection with three adults from the Napo region confirms the characters here ascribed to the former, and suggests the possibility of the specific distinctness of the Peruvian bird. In spite, however, of the well marked differences in size and color, particularly of the lores, which it presents, it is doubtless only a racial representative of *flavigularis*, with which it may therefore be expected to intergrade.

Ochthœca keaysi,[1] sp. nov.

Char. sp.—Apparently most nearly related to *Ochthœca diadema* (Hart.) but forehead rufescent, no superciliary streaks; under wing-coverts not yellow.

Description of Type (No. 74100, Am. Mus. Nat. Hist., ♀, Inca Mine, Peru, Aug. 4, 1900, H. H. Keays).—Upper parts brownish olive-green, the forehead, orbital region, and rump rufescent, the latter darker; rectrices and remiges blackish the feathers margined externally with the rufescent color of the rump, lesser wing-coverts like the back, greater wing-coverts narrowly margined on the outer vane and apically with the color of the rump; throat and breast dusky yellowish olive-green, flanks and thighs the same but rufescent; abdomen pale yellow more buffy posteriorly; bend of the wing rufescent, under wing-coverts olivaceous.

Measurements.—Wing, 2.05; tail, 1.70; tarsus, .72; exposed culmen, .40 in.

Remarks.—This species is represented by a single specimen. As far as can be determined by a description its nearest known ally is *Ochthœca diadema* though it is evident that the relationship is by no means close. A pale yellow feather growing from the interscapulum of the type is doubtless abnormal.

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[1] Named in honor of its collector, Mr. H. H. Keays.

Terenura xanthonota, sp. nov.

Char. sp.—Apparently most nearly related to *Terenura callinota* (Scl.) but with the back lemon-yellow, the interscapulars streaked with black.

Description of Type (No. 74103, Am. Mus. Nat. Hist., ♂, Inca Mine, Peru, Aug. 21, 1900, H. H. Keays).—Crown and nape black, back yellow, olive-green anteriorly, the rump greenish, the interscapulars broadly streaked with black ; tail fuscous edged externally with olive-green, the outer feathers narrowly tipped with whitish ; quills fuscous edged externally with olive-green, lesser wing-coverts, under-wing coverts, and bend of the wing lemon-yellow, median and greater wing-coverts black, less intense in the latter, conspicuously tipped with greenish-white ; sides of the head and neck, including a line over the eye, throat and breast, light gray or grayish white, rest of the under parts, including the under tail-coverts, pale greenish-yellow.

Measurements.—Wing, 2.10 ; tail, 1.65 ; tarsus, .54 ; exposed celmen, .47 in.

Remarks.—Mr. Keays' collection contains but one specimen of this new species, which is so different from any of the described forms of *Terenura* that it introduces a new type of coloration into the genus.

Article XX.—DESCRIPTIVE CATALOGUE OF THE NOCTUIDÆ FOUND WITHIN FIFTY MILES OF NEW YORK CITY.

By William Beutenmüller.

Plates XXXV–XXXVIII.

The present paper constitutes the fourth part of my work on the Lepidoptera found within a radius of fifty miles from New York City, and is Part I of the Noctuidæ.

It may be seen from the following pages that considerable work is yet to be done on the earlier stages of the Noctuidæ, and we hope that some specialist may be found to undertake this task.

In order to properly understand the terms used in this paper, it has been deemed advisable to insert the illustration appearing on page 230.

Thyatira scripta *Gosse.*

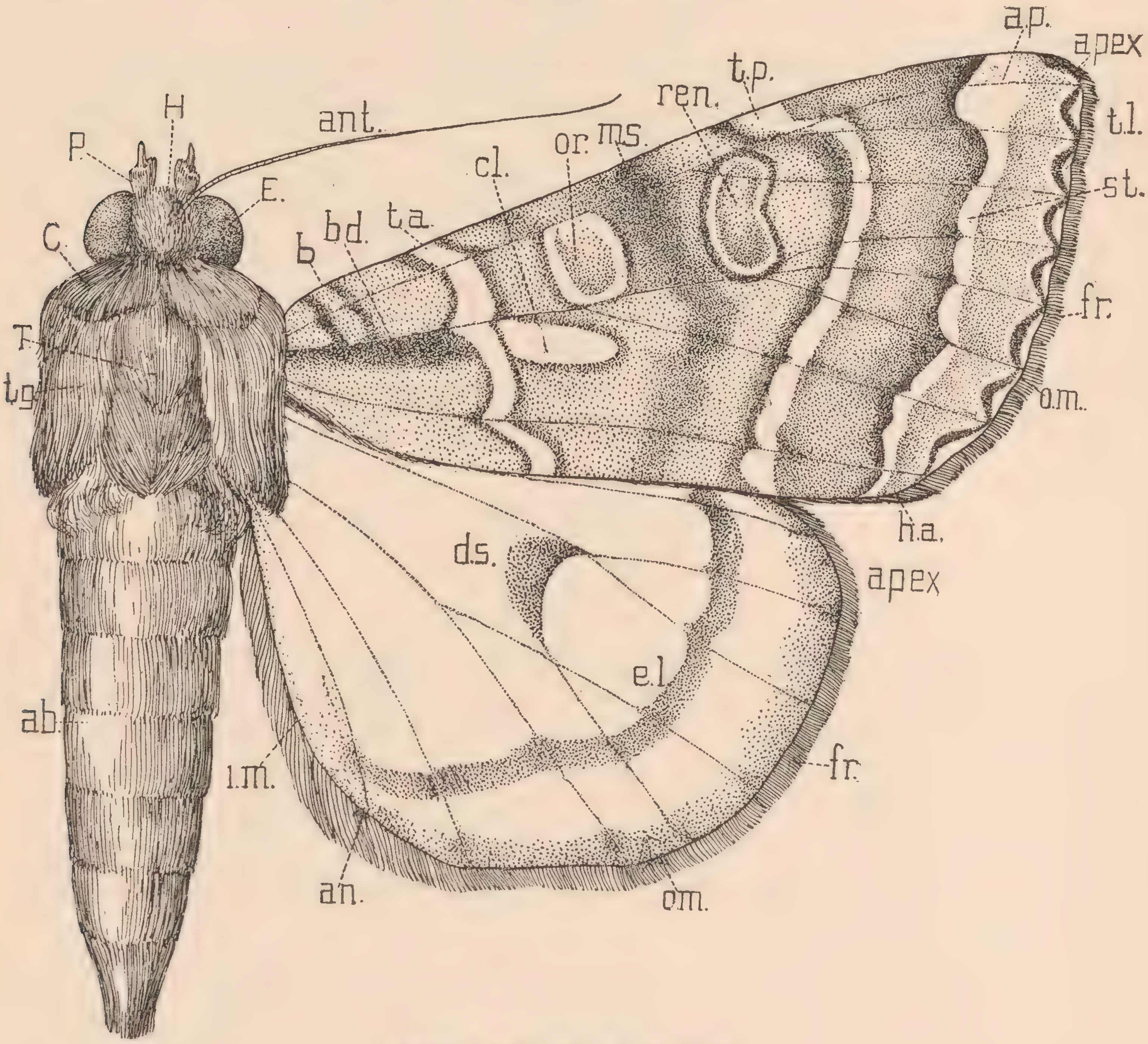
Plate XXXV, Fig. 16.

Fore wings gray brown with a pinkish white curved line from the base of the costa to the middle of the inner margin. On the costal region this line forms a large semilunate white mark. On the outer part of the wing is a rather broad, curved, pinkish white band running from the apex to the hind angle, and a scolloped terminal line. Across the middle portion of the wing are a number of black zig-zag lines, broken by the pinkish white costal area. A brown discal spot present. Hind wing ocher brown with a paler median shade line. Expanse, 30.

Caterpillar.—Rich yellow brown, often almost black. A dorsal black line. Lateral portions more yellow, with black mottlings, and broken by blackish dashes which extend from the dorsal portions anteriorly and inferiorly, becoming pointed about the stigma, where they end. Dorsal part usually much darker than the rest of the body, though subject to considerable variation. In some individuals one, two, or three white spots are present above, placed somewhat anterior to the stigma on the fourth, fifth, or sixth segments; each spot has a central black dot. In some specimens just below the stigma of the third segment there is a white spot, and a smaller lateral spot on the first segment. The second and third segments are somewhat larger than the rest. Head prominent, mottled with yellow and dark brown. Underside dirty yellow. Body tapering posteriorly. Length, 30 mm.

Food-plants.—Raspberry and blackberry.

Not common in this vicinity, but more so northwards. When at rest the larva sits somewhat like a Notodontian, the anterior and posterior parts of the body being elevated, or bent so that the head rests upon the posterior segments. When not feeding it conceals itself in a case formed by curling down the edge of the leaf. Spins a very slight cocoon under leaves on the ground. The moth flies during June and July.



EXPLANATION OF FIGURE.

C.=Collar.
tg.=Tegulæ.
T.=Thorax.
ab.=Abdomen.
H.=Head.
P.=Palpi.
E.=Eyes.
ant.=Antenna.
b.=Basal line.

bd.=Basal dash.
ta.=Transverse anterior line.
cl.=Claviform.
or.=Orbicular.
ms.=Median shade.
ren.=Reniform.
tp.=Transverse posterior line.
ap.=Apical patch.
apex=Apex.

tl.=Terminal lunules.
st.=Subterminal line.
fr.=Fringes.
om.=Outer margin.
ha.=Hind angle.
ds.=Discal mark.
el.=Exterior line.
an.=Anal angle.
I.m.=Inner margin.

Thyatira rectangula *Ottolengui.*

PLATE XXXV, FIG. 18.

Similar to *T. scripta* in color and markings, but differs in having the basal curved transverse line more oblique, angulated, or notched at the middle, and running to beyond the middle of the inner margin. Expanse, 30 mm.

Allied to *T. scripta*, but differs in having the transverse anterior line forming a distinct right angle at the middle.

Euthyatira pudens (*Guen.*).

PLATE XXXV, FIG. 11.

Fore wings gray with a large oblong mark at the base. This mark is white, washed with pink, with a brown spot near the end, outlined by black. On the costa is another prominent pink mark, crossed by the narrow transverse line. At the apex is a similarly colored patch and a small rounded one at the anal angle; the latter is brown outlined with pink and black. Across the middle of the wing is a narrow, sinuate line. Orbicular mark forming part of the mark on the costa; reniform mark small, pinkish and outlined by black. Hind wings dusky. Expanse, about 45 mm.

Very rare in this vicinity. It may be known at once by its stone gray color and conspicuous pink patches. Found during July.

Pseudothyatira cymatophoroides (*Guen.*).

Fore wings pale grayish brown with a pinkish tinge; basal area pinkish red, with a black patch at the extreme base; across the basal third of the wing is a broad black band composed of three irregular lines. Across the apical third a double sublunate line, blackish with three black streaks at the costa and followed by a black patch at the anal angle; before the apex is a black patch, somewhat broken by pink streaks. Subterminal line lunate with a marginal row of black dots. Fringes pinkish ferruginous at anal angle. Orbicular small, round; reniform elongate, both pinkish. Hind wings fuscous. Expanse, 45 mm.

Var. EXPULTRIX (*Guen.*)—Plate XXXV, Fig. 8.—Like *P. cymatophoroides*, but lacks all the black markings. The transverse lines are present, but less distinct, and as a whole the ground color is darker.

Caterpillar.—Rich yellow brown, varying in shade, mottled by fine dark lines. A contrasting white spot just above the spiracles of the fourth segment, rounded and varying in size, sometimes altogether wanting. A fine continuous black dorsal line. Spiracles black brown, slender. Head protruding and darker than the body. Length, 42 mm.

Food-plant.—Oak.

A common species in this neighborhood, found from May until August, inclusive. The caterpillar lives in a case between leaves and when at rest the body is bent, the head approaching the posterior segment. Spins a cocoon on the ground between leaves. Probably double-brooded.

Leptina dormitans *Guen.*

PLATE XXXV, FIG. 7.

Fore wings smoky gray black, with a gray white shade beyond the middle of the median area, broad on the costa and gradually narrowing to the inner margin. Anterior line obscured by the ground color, black, angulate. Posterior line inwardly oblique and bent outwardly below the middle. Subterminal line whitish, more or less broken, dentate; a black shade on costa before the apex. Head and thorax gray. Discal spot small, round, white, with a black centre and ring. Hind wings smoky black, paler basally. Expanse, 28 mm.

Not common. The moth flies in June.

Leptina doubledayi *Guen.*

Fore wings pale gray brown, median area palest. Lower half of base of wing with a silvery white circular area, upper part dark brown. Anterior line obsolete. Posterior line white inwardly, oblique, even. Subterminal line irregular, white, with a brown spot on the inner part at its lower course. Discal spot elongate, dark brown. Hind wings whiter, dusky outwardly. Expanse, 25 mm.

Not common. Flies in June.

Leptina ophthalmica *Guen.*

Allied to *L. doubledayi*, but the transverse posterior line is incomplete. Expanse, 25 mm.

Not common. Flies in June.

Panthea furcilla (*Pack.*).

PLATE XXXV, FIG. 5.

Fore wings very pale gray, more or less scaled with black, sometimes with a very slight rufous tinge. The transverse bands are black, heavy, quite even, except the terminal line. Basal line reaching the submedian vein. Transverse anterior line a little irregular and slightly oblique outwardly. Median line broad, even, and almost upright. Transverse posterior line a little oblique from the costa and at the middle with a broad, even incurvature to the inner margin, the incurvature touching the preceding line. Subterminal line very irregular, sharply dentate, and with two deep incurves. This line is followed by a more or less evident white shade, and there is sometimes a broken, dusky terminal line. Hind wings whitish, smoky at base, and a vague exterior band. Expanse, 34–50 mm.

Caterpillar.—Head round, chestnut brown with conspicuous markings on the front of a lighter red. Body chestnut brown, mottled with irregular broken stripes. On each segment is an irregular band of bright chestnut; a whitish vascular line within a broken gray stripe; a better defined lateral stripe just above the spiracles, within which, on each segment from the third to the eighth inclusive, are four black depressed spots arranged in a right angle, the upper three in line, the largest of which rests on the crown of the segment, with two behind it and one before. The substigmatal fold is white on the anterior portion of each segment and red on the remainder. Rows of tubercles from which clusters of red hairs of unequal length proceed, which on the anterior segments incline to yellow; on the first, second, fourth, and eleventh segments each, are two long pencils of red hairs, darker at the tips. Legs red. Sometimes the body is black with the spots at sides, tufts and hairs white, and the head is shining black with two indistinct whitish frontal marks.

Food-plants.—White pine (*Pinus strobus*) and larch (*Larix americana*).

Rather rare in this vicinity. The moth appears in June and July, and the larva may be found in August and September. It rests extended on a twig with the head drawn down. Spins a double cocoon.

Demas propinquilinea (*Gr.*).

Fore wings white or nearly so, scaled with brown and black, giving the moth a grayish appearance. Transverse lines blackish, but not prominent. Basal line slightly indicated. Anterior line broad, single, upright, or slightly inwardly oblique, with three outward curves. Median shade broad, diffuse, almost upright. Posterior line curving inwards at the middle, denticulate on the veins outwardly. Subterminal line denticulate on the veins, irregular, but parallel with the outer margin. A dusky terminal line is preceded by pale lunules, which are more or less distinct. A rounded discal spot brown-ringed, centered with white. Reniform very narrow, upright, somewhat brown-ringed. Hind wings smoky, paler at base with a vague discal lunule, darker in the female. Expanse, 34–37 mm.

Caterpillar.—Head shining red or blackish brown; clypeus pale. Body very variable in color, the ground color white with numerous transverse wrinkles of a more opaque white, a white band below the depressed spiracles, sometimes broken or absent. Black shadings usually begin at this band, bordering it above, spreading upward, especially in the incisures, till the body may be nearly all black. Hairs short, rather stiff, white or yellowish, those on the last two segments longer and extending over the end of the body. On each of the fourth and eleventh segments, situated close together, one behind the other, are two short pencils of light yellowish red or black hairs, and one on each side of the second segments, black or red. Spiracles white. Length, 24 mm.

Food-plants.—Birch, walnut, maple, oak, beech, chestnut.

Rare in this vicinity. The moth comes forth during May, June, and July. The larva lives in a sort of case made by folding a leaf or drawing two leaves together and attaching them by their edges with silken threads.

Demas flavicornis *Smith.*

PLATE XXXV, FIG. 13.

Fore wings pale gray with the markings obscurely defined. Transverse anterior line almost upright with a strong outward tooth at the middle, meeting a similar one from the following dentate transverse line, and below these two teeth the wing is obscured with smoky brown. Subterminal line irregular, denticulate. Discal spot round, brown-ringed. Reniform spot elongate, indistinct, brown-outlined, resting on the transverse line. Hind wings dusky in male, whitish in the female. Expanse, 27–44 mm.

Not common. The caterpillar lives on beech between two leaves spun together. The moth appears in May and June.

Charadra deridens (*Guen.*).

PLATE XXXV, FIG. 3.

Fore wings white with gray and black powdering and ornamentation. Transverse anterior line black, single, bent on the costa and then almost upright to the inner margin, giving off an acute outward tooth at its middle to meet a similar indentation of the transverse posterior line. Transverse posterior line single, black, starting from a black blotch on the costa, denticulate on the veins. Median shade diffuse, brownish rather than black, a little bent on costa, then evenly oblique to the inner margin. Subterminal black, irregular, sometimes quite vague centrally. At the margin is a series of more or less distinct white lunules, beyond which the fringe is dusky. Discal spot round, black outlined, with black centre. Reniform elongate, narrow, with black centre. Hind wings smoky, paler at base. Expanse, 35–45 mm.

Caterpillar.—Head variously marked from shining black with a few straw-colored frontal spots to light straw color with black marks. Body white to blue, green or black to brown, with tufts of long, fine, silky white hair from distinct warts. A few black hairs grow from the stigmatal wart on the first segment. Length, 40 mm.

Food-plants.—Oak, birch, elm.

Quite rare; found during May, June, and July. The moth may be readily known by its gray white ground color and contrasting black lines on the fore wings. The caterpillar lives concealed in a case between two leaves. It spins a close outer cocoon of fine pinkish silk and a coarse inner cocoon of brown silk.

Raphia frater *Gr.*

PLATE XXXV, FIG. 6.

Fore wings smoky gray, more or less shaded with black and sometimes also with ocherous. Across the basal third is an oblique outcurved black line running obliquely inward, and somewhat irregular; another line across the outer third, which is strongly bent inward at the middle. Subterminal line irregular, slightly edged with whitish gray outwardly. Orbicular round, black ringed. Reniform rather large, black ringed and with a black centre. Between the lines the wings are more or less shaded over with black. Hind wings whitish, with a broken black line before the fringes, which are grayish. At the anal angle is a black patch. Expanse, 30–38 mm.

Caterpillar.—Head rather large, bluish green, with minute lateral black points. Body generally dark, somewhat bluish green, though subject to considerable variation in tint, and covered with scattered bright yellow points, about twenty to each segment. A dorsal hump on the second segment, surmounted by two short, blunt red prominences. On the dorsal area of the second, eighth, and eleventh segments is a transverse mottled red purple band, interrupted centrally and somewhat crescent-shaped, bordered posteriorly and externally with more or less clear yellow. On each of the first and second segments is a lateral red point. Legs and prolegs light green, anal pair tipped with red. Length, 40 mm.

Food-plants.—Poplar and willow.

The moth is found during May and June, and probably is double-brooded. The Caterpillar is stout, tapering somewhat posteriorly and ending abruptly. It usually rests on the midrib on the under side of a leaf. Spins a stout cocoon, usually on bark.

Raphia abrupta *Gr.*

Fore wings gray; the transverse anterior line forms an angle at the middle from which it sends a narrow black line to the posterior line. Above this, and between the two transverse lines the ground color is usually whitish gray. Orbicular and reniform marks as in *R. frater.* Hind wings gray. Expanse, 25–35 mm.

Resembles *R. frater*, but differs by the anterior line on the fore wings forming an angle at the middle as it bends inward, and by the pale whitish area between the two transverse lines. Found in June, and quite rare.

Feralia jocosa (*Guen.*).

PLATE XXXV, FIG. 15.

Fore wings varying from pale green to light olive, and various shades of yellowish buff, with the markings more or less broken and the median space sometimes more or less covered with black scales. The transverse double lines, black with white centres, waved, dentate or irregular. No subterminal line. Orbicular and reniform concolorous, of good size, with black and white annuli. At the hind angle a black patch. A row of small terminal intervenular black and white dots, opposite to the fringes which are broadly black-checked. Hind wings blackish. Head and thorax like the fore wings, marked with black. Expanse, 34 mm.

Caterpillar.—Head yellowish green. Body semi-transparent, varying from light to darker green, finely granulated, with dorsal and subdorsal chalky white stripes running from the first to last segment. Dorsal stripe nearly uniform on the thoracic segments, then widening in the middle of each segment and narrowing on the junctions. Subdorsal line somewhat similar, At the sides along the spiracles is a row of cream colored spots, broadly edged above with cherry red. At the base of legs a line of cream colored oblong spots. Length, 32–35 mm.

Food-plants.—Hemlock (*Tsuga canadensis*) and balsam-fir.

This pretty species may be found from the last of March to the end of April. The moths emerge from their pupæ about noon and ascend the trunks to develop their wings. They are easily found, owing to their bright colors, which contrast with the dark bark of the trees. They seem to prefer spending their lives high up amongst the foliage of the trees, so much resembling their own colors. The larva spins a soft cocoon made of earth and silk, in the ground, or forms a cocoon on the surface, covered by moss and dried hemlock leaves. The larvæ may be found fully grown late in May and early in June.

Feralia major *Smith.*

A larger and broader winged species found in northern New York, and the District of Columbia. Possibly may also be found in this vicinity. It flies in April and May.

Momomophana comstocki (*Gr.*).

Fore wings light, bright green with the spots indistinctly margined, large, between which the cell is black. Anterior and basal lines black and white, incomplete. The space beyond the reniform and inferiorly on the median space to the submedian fold is black. Posterior lines indicated by black shades which commence on the costa near the apex, narrowing to the pale green terminal space, which lacks the usual terminal dots. Hind wings pale green, shaded with fuscous, with a vague band and discal spot. Head and thorax green. Expanse, 34 mm.

Recorded from New York (Ithaca) and Canada. Possibly may be found in this vicinity. It flies in May.

Moma fallax *H.-S.*

PLATE XXXV, FIG. 2.

Fore wings pale green, sometimes shaded with white. Along the costa is a series of about eight short black marks. From the base of the wing at the middle is an abbreviated black dash, followed by an irregular black mark. In the cell is a square black spot, and beyond, across the apical third, are two triangular black marks with a small spot between them; the upper mark is elongate, with a distinct tooth pointing inward, while the lower mark is more or less distinctly triangular. Fringes distinctly marked with black spots. Hind wings dusky, paler basally, with a series of black spots at the base of the fringes, which are white. Expanse, 27–33 mm.

Not common and easily known by its bright pale green fore wings with black marks. It is found in May and June, and again in July and August.

Apatela rubricoma (*Guen.*).

Fore wings somewhat luteous gray powdered with black atoms; the luteous tinge more or less prominent. Transverse anterior line not very distinct, blackish, outwardly oblique and irregularly dentate and lunate. Transverse posterior line strongly lunate within and dentate on the veins outwardly. A row of small dots on the outer margin; fringes cut with brown. Orbicular round, ringed with brown; reniform large and occasionally suffused by a dusky shade. There is a vague dusky shade or dash in the sub median interspace from the transverse posterior line outward. Hind wings whitish with a luteous tinge in the male, dusky in female. Expanse, 31–45 mm.

Caterpillar.—Head black, shining, clypeus brownish, suture pale. Body greenish white with a blackish dorsal band, pulverulent, obscurely geminate, often absent, or broken into spots from the fourth to the last segment, or fourth to ninth segments inclusive, and the last segment. On each of the black spots, except the tenth and last, is a long pencil of yellow or black hairs. Over the body are also fine yellow hairs. Length, 40 mm.

Food-plant.—Hackberry (*Celtis*).

Found during May, June, and July ; not common.

Apatela americana (*Harris*).

PLATE XXXVI, FIG. 4.

Fore wings ashen gray, sometimes with a yellowish tinge. Transverse anterior line geminate, usually incomplete, sometimes hardly traceable ; outwardly oblique and dentate. Transverse posterior line distinct, but not sharply defined, denticulate on the veins outwardly. In some examples there is a dark shade running from the costa to the reniform, which is large, and sometimes incomplete. Orbicular small, black-ringed. Fringes cut with smoky brown spots. In the submedian interspace, crossing the transverse posterior line, is a narrow black dash. Hind wings smoky brown or blackish. Fringes white. Expanse, 50–62 mm.

Caterpillar.—Head large, shining black, labrum pale. Body pale greenish white, with a series of geminate dorsal spots in the incisures of segments four to ten, and a large black patch on eleventh and twelfth segments. Along each side there are traces of two narrow black lines. Warts small with bunches of long white or pale yellow hairs. On each of the fourth and sixth segments are two long black pencils and a similar one on the eleventh segment. Underside and thoracic feet black. Length, 70 mm.

Food-plants.—Maple, linden, poplar, willow, birch, chestnut, oak, elm, alder, hickory, ash, sycamore, beech, etc.

This is the largest and one of the most common species. It makes its appearance in June and July, and the larva may be found in August and September. It spins a double cocoon ; the outer web is thin and consists of silk and larval hairs ; the inner cocoon is thick and is composed of silk and chips of wood interwoven. The cocoon is formed on a piece of wood, and consists half of the cocoon and half of the cavity in the wood formed by the removal of the chips to construct the cocoon.

Apatela hastulifera (*A. & S.*).

Fore wings light gray, powdered with darker gray. Transverse anterior line oblique, wavy. Transverse posterior line dentate outwardly on the veins. A row of terminal black dots, orbicular and reniform spots present, and a black dash on the submedian interspace crossing the posterior line. Hind wings white with a yellowish tinge in the male, and a terminal row of small black spots; wings smoky in the female. Expanse, 42–50 mm.

Caterpillar.—Head shining black. Body along each side densely covered with rusty brown hairs of even length, dorsal region from the fourth to last segment densely covered with black and white hairs, giving it a gray appearance. On each of the fourth, sixth, and eleventh segments is a concolorous tuft, slightly exceeding the other hairs on the back. Body black above and below. Spiracles white. At the extremities are a few longer hairs. Length, 40 mm.

Food-plant.—Alder (*Alnus*).

The moth appears during the latter part of May and in June. It somewhat resembles *A. americana* and *A. dactylina*, the latter more than the former. It differs from *americana* by its paler ground color, smaller size, single posterior line, and white hind wings in the male. From *dactylina* it differs by the presence of yellowish shading on the hind wings of the male.

Apatela dactylina *Gr.*

Fore wings light gray with darker gray powdering. Transverse anterior line variably evident, geminate, evenly oblique outwardly and moderately outcurved between the veins. In many cases a mark below the cell is all that is present. Transverse posterior line lunate, black, more or less dentate outwardly on the veins, almost parallel with the outer margin to a little below the middle where it sharply bends inward. A series of black terminal dots present. Median shade dusky, indistinct and clouding the reniform mark. Orbicular small, round, and dark-ringed. Secondaries white in the male, smoky in the female. Expanse, 42–50 mm.

Caterpillar.—Head black, line above labrum white. Body black, densely covered with long light yellow hairs along the sides, shading into flesh brown on the back. The fourth, sixth, and eleventh segments each have a long black pencil, twice as long as the other hairs. Beneath the spiracles is an irregular yellowish band, concolorous with the lateral hairs. Spiracles white. Length, 50 mm.

Food-plants.—Birch, willow, alder.

Not common; found during May and June. The caterpillar constructs a cocoon similar to that of *A. americana*.

Apatela populi (*Riley*).

Fore wings white, with very fine black powderings that are quite evenly distributed, and with all the markings broken. Basal line marked by a black costal spot, usually by an angulated mark below the median cell, and sometimes by a black spot at about the middle of the inner margin. Median shade indicated by a quite prominent black spot on the costa. The transverse posterior line is most nearly complete, but not continuous, and only partly distinct. When least marked there is only a black spot or two opposite the cell and a black lunule opposite the hind angle. A short black basal streak present. Opposite the cell and hind angle, there are usually indications of a short black streak from the transverse line. A series of black terminal dots, beyond which the fringes are cut with black. Orbicular absent or very faintly indicated. Reniform vaguely defined as a blackish, lunate mark. Hind wings white, with black terminal dots. Expanse, 33–47 mm.

Caterpillar.—Head shining black, as are also the thoracic feet and cervical shield. Body sordid white covered with long yellow hairs. On each of the fourth, fifth, sixth, seventh, eighth, and eleventh segments is a long black pencil, those on the fourth and eleventh more persistent. On the second and third segments the body is brown dorsally. Underside shaded with brownish. Leg plates partly black. Length, 50 mm.

Food-plant.—Poplar.

Quite rare in this vicinity and seldom taken by collectors. It is found in May and June. Allied to *A. lepusculina*, but paler and lacks the orbicular spot; the basal streak is also much shorter. Said to be double brooded.

Apatela lepusculina (*Guen.*).

Plate XXXVI, Fig. 2.

Fore wings white, uniformly powdered with black, giving the insect a grayish appearance. Transverse anterior line more or less distinct and complete. Median line usually indicated by a black mark on the costa and very rarely crossing the wing. Posterior line usually complete, dentate on the veins. Basal streak connected with the anterior line at the middle. Posterior line crossed by a black dagger-like mark opposite the hind angle. Orbicular small, black-ringed. Reniform more or less distinct. A series of terminal black dots present, cutting the fringes beyond. Hind wings white, with a terminal dark line or dots. Expanse, 37–50 mm.

Not common; it has been recorded from Long Island, but is undoubtedly also found elsewhere in this vicinity.

Apatela innotata (*Guen.*).

Fore wings dirty white. Transverse anterior line indicated by a black spot on the costa, or very indistinctly running across the wing. Transverse posterior line well marked, continuous, or broken, not dentate. On the costa at the middle is a black spot, indicating the median shade. Orbicular wanting in most specimens. Reniform varies from a distinct black crescent mark to a vague dusky lunule. Hind wings dirty white. Expanse, 35–47 mm.

Caterpillar.—Head, hind part pitchy-brown, front dirty white, with the mandibles pitchy. Body above, dull grayish brown, with a series of four shining black piliferous spots on each segment on the dorsal region from the second to the last segment, and two rows of yellow spots along each side with another row of black spots between. Underside dull grayish. Legs and feet concolorous. Body also sparsely covered with sordid white hairs. Length, 25 mm.

Food-plant.—Hickory (probably).

Not common. Found in June, July, and August. Spins a rude cocoon.

Apatela betulæ (*Riley*).

PLATE XXXVI, FIG. 6.

Fore wings pale ocher yellow shading into luteous. Anterior line very feebly marked, so as to be hardly visible, oblique outwardly. Transverse posterior line pale whitish, outwardly shaded with rusty brown. It is irregular, distinctly toothed on veins three and four, then curves inward and forms another outward tooth a little above the inner margin. Orbicular very small, ill-defined, dusky, or absent. Reniform sublunate, darker than the ground color. No terminal dots or basal streak. Hind wings pale luteous. Expanse, 35–39 mm.

Caterpillar.—Head pale brown, thickly mottled with black spots on the cheeks; tops of lobes orange. Body dull olive brown, with minute black skin thorns on a greenish ground. A faint, pale dorsal line present. Warts small, few-haired. Two rows of dorsal warts, black, other warts greenish; all pale on joint twelve. Length, 30 mm.

Food-plant.—Birch (*Betula nigra*).

Very rare in this vicinity and probably two-brooded. The moth appears in June, July, and in August at Washington, D.C. The larva when at rest is stretched on the thick branches of the tree and is fond of hiding in dark recesses. It forms a slight cocoon, either among leaves or in old wood on the ground or tree.

Apatela morula (*G. & R.*).

Fore wings pale ashen gray with a yellowish tinge, with the markings in most instances distinct. Transverse anterior line brownish yellow, outwardly oblique, quite strongly toothed on the subcostal and more or less distinctly bent on the veins. This line has a tendency to become quite faint or entirely wanting below the middle. About the middle of the wing is a rather defined yellow or brown line, oblique to the reniform, and occasionally there is a shading which extends almost to the innner margin. Transverse posterior line distinct, narrow brown, or black, preceded by paler and followed by a darker brownish or ocherous shading. The line is rather even, most sharply toothed on veins three and four, below which it makes a deep incurvation. An indistinct but traceable subterminal, irregular pale line is also present. Fringes cut with brown or black. At the base of the wing is a distinct black dash. There is a dark dash opposite the cell, extending to the outer margin. Another black dash opposite the anal angle extends from the margin through the posterior line. Thorax with the disk distinctly ocherous. Hind wings smoky, darker in the female. Expanse, 40–50 mm.

Caterpillar.—Head large, suture deep, black, shagreened, apices of lobes tipped with red, with a central, arrow-shaped light brown mark and several lateral whitish streaks. Body light olive gray, a lozenge-shaped dorsal enlargement on the fourth, seventh, and eleventh segments, darker than the body and edged with black. A dorsal black or gray band contracted between each segment, and containing a white central line. Lateral region irregularly shaded with gray. A lateral brown band, defined by blackish marks stigmatally. Warts rather small, with few to several hairs, those on the sides whitish. Legs greenish. Thoracic feet black. Underside dirty greenish. Length, 50 mm.

Food-plants.—Elm, linden, apple.

Found during June and July; not common. May be known by its large size, pale color, and yellowish shadings on the fore wings. In general appearance it resembles *A. occidentalis*, but is considerably larger. The larva spins a tough cocoon on or under bark.

Apatela occidentalis (*G. & R.*).

Fore wings pale ashen gray, sometimes with a faint yellowish shading. Anterior transverse line outwardly oblique geminate, black on the costa, becoming broken and less defined towards the inner margin. Transverse posterior line dentate on the veins outwardly, curved inwardly at the middle. A distinct black, dagger-like dash a little above the angle, running inward across the posterior line and a black basal dash to the anterior line. On the costa between the lines are also a few black marks. Orbicular and reniform present. Hind wings smoky in the female, paler in the male. Expanse, 35–42 mm.

Caterpillar.—Head large, slightly bilobed, flat in front; blackish mahogany red, darker below; clypeus black, sutures purplish. Body purplish or flesh-color. Eleventh segment enlarged dorsally in a rounded quadrate elevation which is uniformly black. Dorsally a broad blackish band, marked with a series of black patches on the fourth to tenth segments, each throwing out a lateral spur which curves around the second row of warts, and containing the first row of pale warts, and two red spots situated in the dorsal line. Sometimes the spots are connected into a single hourglass-shaped spot. Warts slight, consisting of an aggregation of three to ten piliferous tubercles with a slightly enlarged common base. Hairs thin, long, reddish. A faint lateral black line is also present. The lilac color of the body shades into blackish subventrally. Length, 25 mm.

Food-plants.—Apple, plum, beech, birch, elm.

Very common everywhere from May to September; double-brooded. The moth is allied to *A. morula*, but is considerably smaller, and lacks the yellow patch on the thorax. The caterpillar spins a thin cocoon in the earth when ready to pupate.

Apatela lobeliæ (*Guen.*).

PLATE XXXVI, FIG. 14.

Fore wings light gray with blackish powdering. Anterior line geminate, distinct. Basal line indicated on the costal half. Posterior line whitish inwardly and black outwardly, lunate, dentate outwardly. There are also traces of a pale subterminal line. Fringes cut with black. A median shade slightly indicated or absent. At the base is a rather broad black streak; a black dash above the anal angle, and another dash opposite the cell from the posterior line outward, but not touching the margin. Orbicular and reniform connected below by a prominent black dash. Hind wings smoky in the female, paler in the male. Expanse, 45–60 mm.

Caterpillar.—Head black, with two red spots on top and a grayish white transverse band above the clypeus, which is gray; mouth parts black. Body slaty gray, a greenish white dorsal and subdorsal line, and diffuse lateral and substigmatal patches. Eleventh segment elevated, the top gray with four quite large piliferous spots. Warts whitish, each bearing a black hair. Sides of body quite thickly covered with white hairs. Spiracles white, ringed with black. Underside greenish white. Length, 35 mm.

Food-plant.—Oak.

May be readily known by its large size and prominent black dashes. Found in May and June and again in July and August and probably is double-brooded.

Apatela furcifera (*Guen.*).

Fore wings dark ash gray, quite heavily powdered, and with a somewhat smoky suffusion; markings fairly well defined. Basal line geminate, extending to the basal black dash which is broad and thick. Anterior line geminate, outwardly oblique and quite even. Median shade feeble. Transverse posterior line geminate, the inner line smoky and not well marked, the outer line black, lunate, the intervening space paler than the ground color. A series of terminal black dots, cutting the fringes. There is a dagger mark opposite the cell which but rarely touches the posterior transverse line. A similar mark in the submedian interspace usually crosses the transverse posterior line, and is much heavier than the other. Orbicular and reniform connected by a black line below. Hind wings smoky white in the male, darker in the female. Expanse, 37–45 mm.

Caterpillar.—Head shining black, bilobed, with a red patch at the apex of each lobe. Body dull black, warts pale brown, except the first row, with central hairs and a crown of reddish hairs. A dorsal bright red stripe from the second to the eleventh segments, narrowly edged with velvety black, broken at the incisures. Eleventh segment somewhat elevated. Feet pale. Length, 35 mm.

Food-plants.—Different kinds of wild cherry.

Allied to *A. lobeliæ*, but darker and distinctly smaller, and the markings are somewhat less prominent. After the last moult the larva hides at the base of the tree when not feeding. When younger it is green with a red dorsal band and lives on a web on the upper side of a leaf. The moth is found in June and July.

Apatela hasta (*Guen.*).

Allied to *A. furcifera*, which it closely resembles, but the ground color is a much cleaner gray and the fore wings are rather peculiarly mottled with smoky shadings. The markings contrast more in *furcifera*, and the hind wings in both sexes are much paler than in the preceding species. In the male they are almost white; in the female they are not so dark as in the male of *furcifera*. Expanse, 37–45 mm.

Not common. Found from May until about the middle of July.

Apatela lætifica (*Smith*).

Fore wings creamy white, more or less powdered with black scales, and the markings fairly evident. Transverse anterior line geminate, oblique, more or less broken. Median shade, black-marked on the costa and sometimes traceable as a brown shade, parallel with the posterior line. Transverse posterior line narrow, black, more or less lunate, preceded by a white shade and followed by a blackish or smoky shading. A terminal line of black dots, and the fringes are cut with black beyond. There is a distinct black basal dash, one above the anal angle, and another opposite the cell crossing the posterior line. Orbicular oval, black-ringed; reniform quite small, well defined outwardly, and sometimes entirely complete. Sometimes a black line connects these spots below. Hind wings smoky in both sexes, paler in the male with a yellowish tinge. Expanse, 37–40 mm.

May be known by the creamy white primaries, somewhat like

A. occidentalis or *A. morula*, but paler with a more silky lustre than either. It may also be confused with *A. furcifera*. The moth is found in June and July.

Apatela vinnula (*Gr.*).

PLATE XXXVI, FIG. 7.

Fore wings milky white, more or less shaded with greenish or luteous. Basal line geminate, marked on the costa with greenish or black. Transverse anterior line geminate, bluntly toothed on the veins, green, black or gray, or partly of each color. A distinct median shade is present, greenish, or the part between the costa and the reniform mark may be black. Transverse posterior line geminate, the outer line narrowly black, the inner greenish, with the space between usually white. The line curves around the cell, then incurves at the middle. Subterminal space greenish, whitish terminally, where there is a line of small black dots. At base of wing a distinct black dash, which is more or less broken, and a black mark or dash below the incurve on the posterior line. Orbicular and reniform marks completely defined in either black or green. Hind wings dirty white in the male, dark in the female. Expanse, 26–32 mm.

Caterpillar.—Head bilobed, rounded, green, with a pulverulent brown patch on the upper part of the face. Body green, a narrow subdorsal band, bent upwards on segments four and eleven. Faint dorsal and substigmatal lines. Prominent tubercles, brownish. Warts with a central seta and crown of short hairs, dark on warts I–III, pale on IV–V. Body higher than wide, thorax thicker than the head. Length, 24 mm.

Food-plant.—Elm.

Easily recognizable by the white ground color with well-defined green shadings and markings. It varies considerably in the amount of contrast between the ground color and the markings. Double-brooded, May to August.

Apatela fragilis (*Guen.*).

PLATE XXXVI, FIG. 16.

Fore wings white, overlaid by smoky brown shades. Transverse anterior line dentate, geminate, black; space between white. Median shade blackish, not well defined and irregular, broken by the reniform mark. Transverse posterior line geminate, blackish, space between white. It is dentate on the veins outwardly, beyond which the wing is smoky brown black, relieved by an irregular, white subterminal line. Basal dash suffused by the ground color. Orbicular round, black-ringed, with a white center. Reniform mark, kidney-shaped, black-ringed, with a smoky disc. Hind wing white in both sexes. Expanse, 30–33 mm.

Caterpillar.—Head slightly bilobed, green with a reddish brown shade on the vertex of each lobe. Body green, elevated on the third to sixth segments when at rest. Eleventh segment somewhat enlarged dorsally; a narrow yellowish white subdorsal line along the second row of warts. First row of warts in a purple brown area. Hairs on first three rows of warts black, the rest pale. Spiracles dark brown, small. The dorsal shading may be more extensive, suggesting the filling in of the dorsal space.

Food-plants.—Birch, mountain ash, apple.

Not common in this vicinity; found during June and July.

Apatela lithospila (*Gr.*).

PLATE XXXVI, FIG. 17.

Fore wings very dark bluish gray with dusky longitudinal streaks, the spaces between grayish. An irregular broken transverse posterior line present; also a narrow black basal dash and traces of a similar dash above the anal angle to the posterior line. Orbicular and reniform marks hardly traceable. Hind wings with a yellowish tinge, dusky outwardly. Expanse, 33–37 mm.

Caterpillar.—Head green, narrowly sordid brown on the apices of each lobe. The color shades down the angles in mottled spots on a yellow ground. Body bright green, darkest dorsally, with a dull pink stripe, triangularly formed on the six anterior segments, then widening very much till the whole dorsum is covered on the seventh, eighth, and ninth segments, then narrowing again to the anal extremity. The middle and broad part of this mark is darker than the anterior and posterior parts. Body covered with rather long hairs, which spring from small pinkish warts. Underside dull green. Length, 35 mm.

Food-plants.—Hickory, oak, chestnut.

Found during May, June, and July, and is probably double-brooded. It may be known by its dark colors, with darker longitudinal streaks on the fore wings, and by the almost total absence of the transverse lines.

Apatela funeralis (*G. & R.*).

Fore wings varying from chalky white to quite dark gray. Basal line black, marked on the costa only. Transverse anterior line usually single, marked by an oblique dash on the costa, sometimes traceable as a geminate brown line to the black basal streak. Median shade marked by a black blotch on the costa. Transverse posterior line white, squarely bent outward over the cell and incurved below the middle, partly geminate, outer line black not lunated. Beyond this line the wing is almost uniformly gray with traces of a pale irregular subterminal line. Fringes cut with black. At the base there is a long black streak which runs to nearly the posterior line, in some cases touching it. Below this line the wing is black or dark smoky. Above the anal angle from the outer margin is a black streak, running across the posterior line so as to connect with the basal streak. Orbicular and reniform marks present. Hind wings white, with traces of an outer smoky line, and the veins somewhat dusky. In the female the hind wings are white at the base and blackish outwardly. Expanse, 31–38 mm.

Caterpillar.—Head large, black, shagreened. Body dull sooty black with a transverse elliptical slightly raised creamy white patch on each of the first to the last segments. The patches on the second, third, eleventh, and twelfth segments are a little smaller than the rest, and those on the fourth and eleventh have a central, transverse, depressed, narrow black line. Warts with black hairs. First and second rows of warts white; third to sixth rows black, all single haired except the sixth, which bears two or three hairs. Hairs short, black, two on each side of the cervical shield. Segments four to nine, eleven, and twelve have long black spatulate hairs. Length, 38 mm.

Food-plants.—Elm, apple, hickory, birch.

Quite rare in this neighborhood. It is a variable species, but the chalky white ground color with jet-black markings will readily serve to distinguish it from all other species.

Apatela tritona (*Hüb.*).

PLATE XXXVI, FIG. 1.

Fore wings slaty bluish gray, with the transverse anterior line very feebly indicated. Posterior line distinct, black outside and preceded by a pale shade, dentate on the veins, curved inwardly below the middle. At the base is a narrow black dash, and another prominent black dash extends inwardly from just above the anal angle, crossing the posterior line, where there is a diffuse smoky brown shade. Orbicular small; reniform feeble. A pale grayish subterminal shade is also present. Thorax slaty gray. Hind wings smoky, with an ocherous tinge, paler basally.

Caterpillar.—Head rosy pink, becoming darker at the sides and merging into shining light brown, mottled with darker spots on top. Body yellowish green with a purplish brown dorsal stripe, furcate and black on the first segment. The stripe widens a little on the fourth segment, is absent on the fifth, and begins again on the sixth, but after extending halfway across the segment it splits into two lighter dull purple stripes, which diverge slightly, then run parallel, grow darker, and approach each other, meeting on the eleventh segment, thus enclosing an elliptical area; the stripe becomes more purple in color and extends over the anal plate. Warts slightly raised, most of them crowned with a short, dark blunt bristle, and surrounded with a few long hairs. Spiracles small, black. Underside with white pubescence. Length, 27 mm.

Food-plants.—Cranberry, azalea, deerberry.

Not common. It may be known by the almost uniform slaty blue gray fore wings, with the prominent basal streak and dagger mark near the anal angle. Found during May, June, and July.

Apatela radcliffei *Harv.*

Fore wings uniform, pale bluish ash gray with the markings neatly defined. Basal line running to the black dash. Anterior transverse line oblique, geminate, rather even, inner line blackish, the outer smoky. Transverse posterior line black outside, the inner faintly visible, with the shade between light gray. Basal dash distinct. The dagger-like mark above the anal angle, distinct and crossing the posterior line. Orbicular large, round ; reniform kidney-shaped, both partly black-ringed. Hind wings white in male, dusky outwardly ; in the female dusky. Expanse, 35-40 mm.

Caterpillar.—Head black, upper part red. Body black, with three lines along each side and one on the dorsum, all yellow ; the subventral one twice as broad as the others. All the lines run from the cervical shield to the anal hump. The warts bear thin white hairs. Length, 33 mm.

Food-plants.—Wild cherry and sugar plum.

The moth is found during May and June, and again in August. The larva mimic the larva of *Datana*, by its stripes and in elevating both ends of the body when disturbed. Rare in this vicinity.

Apatela falcula *Gr.*

Fore wings uniform dark leaden gray shaded with rusty brown at the base below the black dash and outside the posterior line. Transverse anterior line geminate, oblique, almost even, inner line black, outer one somewhat darker than the ground color. Transverse posterior line black outside with two rather prominent teeth on veins three and four, incurved below that point, with a tooth before it reaches the inner margin. A faint subterminal, pale shade present. Orbicular and reniform marks not distinct. Basal dash prominent, with a short spur below at about the middle. A prominent black dash above the anal angle, but it does not cross the posterior line. Median and basal lines indicated on costa by dark streaks. Hind wings whitish at base, dusky outwardly. Expanse, 35 mm.

Caterpillar.—Head brownish in front, pale greenish on the sides. Body dark brown, mottled with pale greenish ; a dark dorsal line, on each side of which are two short warts, more distinct on the anterior part of the body ; the four warts on top of the eleventh segment are larger and placed closer together than those on the segments before it. From each of these warts arise one or two short hairs. Underside greenish white. Length, 30 mm.

Food-plant.—Hazel.

Quite rare in this vicinity. It is recognizable by the dark blue gray fore wings, with prominent basal streak, and by the reddish brown shades in the basal area beneath the streak and beyond the transverse posterior line.

Apatela grisea (*Walk.*).

Fore wings ashen gray, a little mottled with brown, giving it a somewhat marbled appearance. Basal line brown, marked on the costa only. Transverse anterior line geminate, quite evenly oblique outwardly; the outer line brown, more or less obsolete, the inner line blackish, also more or less obsolete. Median shade indicated by a smoky streak from the costa, extending obliquely between the two spots. Transverse posterior line black, preceded by a slightly paler and followed by a brownish shade. It is bent outwardly over the cell, strongly toothed on veins three and four and less so on vein one. An indistinct, irregular, pale terminal line. A series of smoky dots at the base of the fringes, beyond which these are cut with black. A distinct black basal streak which is forked from the lower side near the middle. The black dash opposite the hind angle extends through the posterior line and is well marked. Orbicular round, pale, and outlined by smoky scales. Reniform kidney-shaped, the center shaded with brown. Hind wings dirty white in the male, in the female smoky towards the outer margin. Expanse, 30–35 mm.

Caterpillar.—Head dull chestnut brown with some darker markings. Body wholly yellowish green, with a slight brownish tint, or sometimes pale brownish with a flesh-colored tint. On the seventh and eighth segments is a broad brown triangular patch, the mark being continued, slightly reduced in size, to the anal segment. Each segment bears brownish tubercles with short spiny hairs. There is a faint subdorsal brownish line, broken up into patches. Spiracles brown with redder brown patches above and below them. When at rest the third, fourth, fifth, and sixth segments are very much elevated into a hump. Length, 32 mm.

Food-plants.—Elm, apple, birch, willow, viburnum.

Found during June and July, but not common.

Apatela connecta (*Gr.*).

Fore wings gray, mottled with ocherous and black. The markings are more or less traceable, but all of them are obscured by a black shade which extends from the base through the centre of the wing and reaches the outer margin above the hind angle. This shade also includes the black basal streak and outer black dash above the hind angle. The transverse posterior line is very strongly incurved below the middle. Sometimes the entire wing is almost uniform gray with the black shade and the markings very much obscured. Hind wings whitish or smoky. Expanse, 30–35 mm.

Caterpillar.—Flesh-colored, with the dorsum bluish and margined on each side with deep yellow. Dorsal trapezoidal spots with a pale bluish annulation. Under the lens the body is covered with extremely fine elevated speckles, especially the dorsum. First segment with two elbowed lines, diverging in front. Dorsal warts with black hairs, the rest long and light. Underside immaculate. Head and spiracles black. Sometimes the larva is dark green with a broad subdorsal sulphur yellow line. Head with a red stripe at each upper side, reaching from the vertex and pointing downward.

Food-plant.—Willow.

Quite rare in this vicinity. It appears in June, July, and August, and is easily recognizable by the black shade through the fore wing from the base to the outer margin. The caterpillar eats into wood, where it constructs a cocoon.

Apatela brumosa (*Guen.*).

Fore wing very dark, powdery, ash gray with vestiture somewhat elevated; mottled with smoky brown, which obscures the ordinary markings. Basal transverse line brown, geminate, complete. Anterior line brown, geminate, tending to become indistinct below the middle, outwardly oblique. Median shade brown, best marked on the costa, the latter part of the course very largely obscured, and sometimes wanting. Posterior line geminate, the inner line only a little marked, the outer one lunulate and denticulate on the veins outwardly, intervening space pale. Subterminal line pale, irregular, broken, and diffuse. Terminal space crossed between the veins by black streaks, opposite which the fringes are cut with blackish. A brown shading below the median vein from the base to the anterior line, but no distinct basal streak. A similar shading opposite the cell and another opposite the anal angle, taking the place of the ordinary streaks. Between the anterior and median lines is a black streak above the internal vein. Orbicular and reniform spots black-ringed. Hind wings yellowish white in the male, smoky yellow in the female. Expanse, 32–40 mm.

Caterpillar.—Head bilobed, pale, with brown mottled spots on the face. Body olive green, paler subventrally. A broad yellowish white dorsal band, somewhat tinted with pinkish, broken on the fourth, seventh, eighth, and eleventh segments by a large brown spot. A similar fainter mark on the second and tenth segments. Warts on top small, with a few hairs, those on the sides small, flattened, and diffuse, with pale hairs. Body higher than wide, fourth, fifth, and eleventh segments enlarged and humped up in position of rest. Length, 43 mm.

Food-plant.—Witch-hazel.

Not common. Found during May, June, and in August. The species is recognizable by the very mottled fore wings and equally smoky hind wings.

Apatela superans (*Guen.*).

PLATE XXXVI, FIG. 12

Fore wings pale whitish gray, heavily shaded with brown or black. The dark shades extend from the base of the wings below the middle to the outer margin, and from the costa between the orbicular and reniform marks, joining the longitudinal shade ; another shade extends from the outer transverse line to the outer margin opposite the cell. Transverse lines geminate, brown or black, obscured by the black shades, but traceable. Orbicular and reniform marks large, black-ringed, and also partly obscured by the black shade. Subterminal lines white and broken. At the base of the wing on the inner margin is a pale yellow patch. Hind wings smoky in both sexes. Expanse, 40–45 mm.

Caterpillar.—Head brown at apices of the lobes, shading into pinkish below, mottled with black spots, especially on the front angles and in a triangular patch on the ocelli ; sides and labrum nearly white. Body soft, green, with a brownish black dorsal space, bordered by a narrow yellow line on the subdorsum. The dark shade is narrowed on the junctions of the fourth to tenth segments and a little at the twelfth segment, continued narrowly to the end of the body. Eleventh segment angularly elevated, pointed. Spiracles white, ringed with black. Claspers and feet pinkish. Warts low, black on the back, pale at sides, with only a few hairs. Length, 30 mm.

Food-plants.—Plum, cherry, apple, birch, mountain ash.

May be known by the large size, the broad wings with dark brown or black shadings and yellow patch at base of fore wings. The moth comes forth during June, July, and August. The larva when mature enters the earth and spins a tough cocoon.

Apatela spinigera (*Guen.*).

Fore wings very pale ashen gray, sometimes with a slight ocherous tinge. Markings distinct and well outlined. Basal geminate, reaching the black basal dash. Transverse anterior line geminate, brown or black, outwardly oblique and slightly irregular. Transverse posterior line geminate, inner portion faintly visible ; outer line narrow, black, dentate on the veins ; intervening space whitish. The line is squarely bent over the cell and deeply incurved below the middle. Subterminal line irregular, pale. At the base of the fringes is a row of small black dots. Basal dash narrow, extending to the inner transverse line. Opposite the cell there is a fine, narrow, black streak to the transverse posterior line, sometimes barely visible. Above the angle is a black dash, crossing the posterior line. Orbicular and reniform marks large, distinct, and black-ringed or partly so. Hind wings smoky, somewhat paler in the male. Expanse, 37–45 mm.

This species is closely allied to *A. pruni*, and may be known by the very neat black dashes and the general distinctness of the markings. Not common. May, June, and August.

Apatela pruni (*Harris*).

PLATE XXXVI, FIG. 10.

Fore wing very pale whitish gray, with the marking more or less distinct. Transverse anterior line geminate, smoky black, sometimes obsolete below the basal streak. Transverse posterior line geminate, dentate outwardly. The black basal dash runs through the anterior line and is shaded with black beneath. The black dash above the hind angle is also shaded with black above. The streak opposite the cell indistinct or wanting. Orbicular and reniform marks not well defined and more or less outlined by black. Subterminal line irregular, whitish. On the thorax behind the collar is an ocherous yellow spot. Hind wings whitish in the male, smoky in the female. Expanse, 35–43 mm.

Caterpillar.—Head rosy red, sides whitish, with three rows of black spots. Body bright green, the lateral tubercles scarcely discoloring the sides, slightly yellowish green. A dorsal dark reddish purple stripe nearly as wide as the head, on the anterior part of the first joint, about half as wide on the second, narrow on the third to sixth, expanding in two ellipses on the seventh and eighth, the rest of the way narrow. From the first segment to back of the tubercles on the second the stripe is bordered on each side with clear white, colored a little with green on the seventh and eighth and with a faint greenish central line.

Brown form.—Head with clypeus green, the lobes mottled with black and red on a white ground, the lines broken with patches of dots. Body clear, velvety greenish brown. Dorsal band vinous brown, conspicuously edged on joints one and two with white ; very narrow and passing above the first row of tubercles, then broadened on joints seven and eight, mottled with salmon color, last segment vinous. First row of tubercles on segments two to six are produced, red, also four on the last segment. Hairs black ; a central hair and crown of small ones around it. Spiracles white, ringed with black. Length, 30 mm.

Food-plants.—Apple, mountain ash, cherry, plum, wild cherry.

Common everywhere in this vicinity from the latter part of May until about the middle of August. The larva in forming its cocoon bores partly in soft wood.

Apatela afflicta (*Gr.*).

PLATE XXXVI, FIG. 15.

Fore wings very densely overlaid with brown black scales so as to obscure all the markings. The transverse lines are fragmentary and indicated by being deeper black. Subterminal line quite distinct, zigzag, white. Fringes sometimes alternately white and black. Orbicular round, rather large, contrasting, whitish with black center. Reniform mark obscured by the ground color. Hind wings pearly white, dark at the margins and the veins more or less black outwardly. Expanse, 35–43 mm.

Caterpillar.—Head broad, brown with purple reticulations and whitish dots over the face of the lobes. Body nearly uniform reddish brown, a dusky black dorsal stripe, and a faint reddish lateral one. Tubercles very small, orange, each provided with a single hair. Setæ short and fine, except the subdorsal ones on segments four to seven, which are long, black, and slender with club-shaped tips. In some individuals these club-shaped hairs are present on the fourth to eighth and eleventh segments; or second, fourth to ninth and eleventh, or on the second to ninth and eleventh segments. Sometimes the head is yellow brown, lighter externally. Body light yellow brown, tinged with green, darker on top. A white stigmatal line and a distinct black dorsal stripe. The form of the larva is stout, flattened posteriorly.

Food-plants.—Oak, walnut.

This species may be easily recognized by its black fore wings with contrasting pearly white hind wings. It is found in May, June, July, and August. The caterpillar rests with the head touching the posterior end of the body, selecting a withered or discolored leaf on which it is well concealed. The cocoon is tough, composed of silk and bits of wood, partly formed by the substance on which it is made. Not common.

Apatela albarufa *Gr.*

Fore wings lead gray, with a slight reddish tinge in some examples. Transverse anterior line geminate, bent obliquely inward to the middle and then obliquely outward. Median shade very indistinct or only marked on the costa. Transverse posterior line squarely bent over the cell. Subterminal shade light gray. Terminal row of dots small, black. Basal dash extends to the anterior line, where it curves a little upward, forming an oval space at base. Dash above angle black, more or less distinct. Orbicular round, pale, with a darker center. Reniform well defined with a rusty brown center. Hind wing white in the male, smoky in the female. Expanse, 30–37 mm.

Quite rare in this vicinity, appearing in May, June, and July. It may be known by the incurved anterior line, upcurved basal streak, and the red brown reniform mark.

Apatela ovata (*Gr.*).

Fore wings light ashen gray, more or less tinted with yellowish. Transverse anterior line geminate, drawn in at the middle so as to meet the black basal dash. Median shade more or less evident. Transverse posterior line geminate, black, or smoky, the inner less distinct, and the space between pale. The line is bent over the cell and well drawn in at the middle. Subterminal shade whitish, more or less distinct. The basal dash forms an oval costal space. Dash above the hind angle, from the subterminal line, crossing the posterior line. Opposite the cell, beyond the posterior line, is also a small black dash, sometimes absent. Orbicular round, paler than ground color, black-ringed. Reniform large with ocherous center. Hind wings smoky in both sexes. Expanse, 30–40 mm.

Caterpillar.—Head dull purplish red, pale whitish over the clypeus, lower part and central suture and upper two-thirds mottled with spots, composed of groups of little whitish dots in clusters. Body yellowish green or brown, underside pale whitish centrally. Warts yellow, single-haired. Along the back are two rows of large, round, pale yellow spots from the second to the eleventh segments inclusive. Along the sides are two similar rows of smaller spots. Spiracles white with black borders. Length, 30 mm.

Food-plants.—Oak, witch-hazel, beech, chestnut.

Allied to *A. albarufa*, but light gray instead of lead gray, with the markings very much the same as in *albarufa*, but less defined. It is common in this vicinity, though not abundant. It flies from May to July. The caterpillar when at rest lies curled on a leaf. It varies from light yellowish green to reddish brown, and its characteristic feature is the double row of milk-white spots on the back. It spins a cocoon composed of bits of wood and grains of earth on or near the surface of the ground.

Apatela modica (*Walk.*).

PLATE XXXVI, FIG. 3.

Fore wings very pale gray, somewhat shaded with yellowish. The transverse markings are quite indistinct and broken. Transverse anterior line geminate, outwardly oblique, and very slightly drawn inward at the middle. Median shade marked on the costa. Transverse posterior line geminate, both of almost the same color, smoky, but the outer is sometimes a little darker; it is curved over the cell and bent inward at the middle. Subterminal line whitish, irregular. At the margin is a series of pale small lunules, and a row of very small black dots. Basal streak obsolete or scarcely visible, as is also the dash above the angle. Orbicular round, indistinct, pale, and sometimes marked with ocherous. Reniform filled with ocherous in the centre. Hind wings smoky in both sexes. Expanse, 30–35 mm.

Caterpillar.—Head large, light brown, mottled and reticulated with brown;

a blackish band from each lobe above, parallel to median suture meeting a brown V-shaped mark which borders the clypeus, and a heavy brown mottling over the eye, passing backward. Body smooth, cylindrical, eleventh segment slightly enlarged, shaded with blackish. A broad subdorsal shade, broken at the incisures and defined above by whitish, reaches from the first to the eleventh segments, where the shade curves sharply in the incisure of the eleventh and twelfth and forms a black mark on the dorsum of the last segment and anal plate. On the dorsum is a faint, mottled, geminate line, rather sharply defined on the tenth and eleventh segments in a shaded V mark. Rest of body somewhat mottled. Warts very small.

Food-plant.—Oak.

Resembles *A. ovata*, but much paler with the lines less distinct and broken. It is also smaller, and the transverse anterior line not or very slightly drawn in at the middle. The basal black dash, which is so prominent in *ovata*, is in this species almost absent. Not common during June and July.

Apatela clarescens (*Guen.*).

PLATE XXXVI, FIG. 9.

Fore wings of an even ash gray, with all the markings quite prominent. Transverse anterior line geminate, blackish, almost evenly oblique, a little curved between the veins in some specimens. The intervening space like the ground color, but toward the middle of its course becomes filled with smoky black. Median shade marked on the costa, sometimes running faintly across the wing. Transverse posterior line with the outer line black, the inner one smoky or faintly visible, intervening space whitish. Subterminal line whitish, crenulate, and followed by a terminal row of pale lunules. Fringes cut with smoky. Basal dash, as a rule, not reaching the anterior line. Above the hind angle is a black dash, which is more or less distinct. Orbicular round, whitish with a gray center and black-ringed. Reniform filled with gray, white and ocherous. Hind wing smoky in both sexes. Expanse, 30–40 mm.

Not common in this vicinity, and appears from the latter part of May until early in July. It is closely allied to *A. hamamelis*, but is of a uniform gray and not shaded over with black. The dagger mark is always present, while it is absent in *hamamelis*, and the anterior line is never completely filled with black as is the rule in *hamamelis*. The caterpillar is unknown.

Apatela hamamelis (*Guen.*).

Fore wings dull ashen gray more or less heavily overlaid with black. Transverse anterior line geminate, black, outwardly oblique and sometimes lunate between the veins; intervening space usually filled with smoky black. Median shade usually marked on the costa. Transverse posterior line geminate, the inner line less distinct than the outer one, which is rather strongly dentate. Subterminal line irregular, whitish, more or less evident. A terminal row of white lunules, each containing a black dot. Basal space more or less filled with black, containing the black dash, which is not very well defined. Orbicular and reniform marks both present. Hind wings smoky in both sexes. Expanse, 30–38 mm.

Caterpillar.—Head round, flat in front, concolorous with the body which varies from pale straw yellow to yellowish red. A row of connected triangular dark brown spots on the back, and obscure shades and spots of pale brown along the sides. Underside bluish green. Warts and hairs white. Spiracles black. Length, 25 mm.

Food-plants.—Oak, chestnut, birch.

Very common, and variable in color. The outer black dash on the fore wings, above the hind angle, is always wanting. Sometimes the fore wings are gray or with a more or less black basal area, and with a dark terminal area, or they are almost entirely overlaid with black-brown scales so as to almost obscure the black lines. Found during May, June, and July. The larva when not feeding rests with its head turned to the side of the body.

Apatela increta (*Morr.*).

Allied to *A. hamamelis*, but the wings are narrower. The fore wings are considerably darker, with the markings distinct, and usually with a pale median space; the whole wing is more or less suffused with olivaceous green, giving it a different color from the plain dark gray *hamamelis*. It is also smaller. Hind wings smoky in both sexes. Expanse, 27–32 mm.

Very rare; possibly found in this vicinity.

Apatela retardata (*Walk.*).

PLATE XXXVI, FIG. 13.

Fore wings whitish gray, with the basal and outer area shaded with smoky brown. Transverse anterior line geminate, oblique, a little curved, and irregularly lunate. Median shade indistinct, smoky. Transverse posterior lines outwardly dentate. Basal line indicated on the costa. Orbicular and reniform not contrasting, as pale as the ground color, and brown-ringed. A terminal row of small black dots. At the base is an ill-defined black dash to the anterior line, in some examples very obsolete. Hind wings white to smoky, darker in the female. Expanse, 27–30 mm.

Caterpillar.—Head whitish, mottled with pale brown; a row of darker dots close to the sutures of clypeus and median suture. Dorsum to spiracles shaded with purplish and containing transverse bands. Lateral region, underside and feet yellowish waxen white. Dorsal region with fine vinous red bands, the first cut dorsally and not reaching as far down the sides as the others; second broken by the first wart and formed into a pair of rounded spots; third broken by the second wart; fourth narrow, faint dorsally; fifth in the incisure and as long as the first. Warts i, ii, and iii, each in a less degree, short, erect, smooth cylinders, bearing a crown of stiff black hairs. Warts iv–vi small with a few soft whitish hairs.

Food-plant.—Maple.

This is one of the smallest species. The median space is the palest part of the wing, the basal and terminal parts being shaded with smoky brown. It is found during June, July, and August and is not uncommon.

Apatela luteicoma (*G. & R.*).

PLATE XXXVI, FIG. 5.

Fore wings powdery ash gray with the markings not very prominent. Transverse anterior line geminate, lunate, outwardly oblique. Median shade extends obliquely to the reniform mark, then makes an acute angle and extends to the inner margin; sometimes the median shade is scarcely visible. Transverse posterior line geminate, lunate, with sharp dentations outwardly, intervening space white. Subterminal line more or less distinct gray or white; when well marked it is very dentate. A terminal row of black dots. No basal dash and outer streaks present. Orbicular round or oval, black-ringed; reniform large, dusky, and black-ringed. Hind wings dusky, somewhat darker in the female. Expanse, 38–50 mm.

Caterpillar. — Head shining black with a few whitish hairs. Body mottled with black and white. Dorsum with a narrow yellow central line, which runs through a series of velvety black patches. Subdorsal and lateral lines yellow or red. From the dorsal portion of four segments, and placed transversely, project four very thick, smoky black tufts of fine hairs, and externally to these is a small clear white tuft of similar hairs. From the dorsal portion of the eleventh segment, which is elevated, project two long tufts of similar black hairs, and externally to these are placed two white tufts, one on each side, as on the fourth segment. On the fifth segment are six white tufts, placed transversely on the dorsal surface. On the third segment are four similar tufts, and also one on each side subdorsally on the eighth and ninth segments. On the second segment are four tufts. All the tufts have a few longer black hairs. On the sixth to tenth segments are four reddish tubercles with short whitish and black hairs. Anal segment with two tufts. The remaining tufts are composed of long whitish hairs, those on the anterior segments projecting over the head. Length, 35 mm.

Food-plants.—Apple, cherry, walnut, oak, linden, ash, birch, willow, poplar, elm.

A rather large species with narrow fore wings. It is almost uniform powdery gray, with the markings distinctly traceable but not prominent. Found from the latter part of April to July, but not common.

Apatela sperata (*Gr.*).

Fore wings almost uniform powdery gray with all the markings obscurely defined. Basal line marked on the costa only. Anterior line geminate, curved between the veins. Median shade distinct in most specimens. Posterior line lunulate, outer one dark, inner one vague. Subterminal line pale sinuate. Orbicular black; reniform large and obscured by the median shade. Hind wings white in the male, dusky outwardly in the female. Expanse, 30–35 mm.

Caterpillar.—Head shining red brown, side pieces of clypeus yellow. Body pinkish or creamy brown, more or less mottled with blackish shades, especially on the broken dorsal band. Beneath the spiracles is a red band, sometimes scarcely defined. Warts with bristly hairs, light red, brighter on the fourth segment. A few long hairs at the extremities, and tufts of short, fine, feathery whitish hairs from warts i, ii, and iii on the fifth to eleventh segments, more or less abundant. Length, 26–28 mm.

Food-plants.—Alder, poplar.

A rather common species and easily known by the pale dirty gray fore wings with all the markings obscured except the ordinary spots, which stand out in relief. Found during May and June, and again in August.

Apatela noctivaga (*Gr.*).

Plate XXXVI, Fig. 8.

Fore wings white, thickly mottled with deep black, giving a marbled appearance. The transverse lines are geminate and include white spaces. Subterminal line white, broken. Fringes white, cut with black. Orbicular small, black-ringed, and usually filled with black. Reniform obscured by the black shading. Hind wings smoky. Thorax white and black. Expanse, 33–37 mm.

Caterpillar.—Head brown black. Body dull black with a broad, diffuse, red band below the spiracles and a faint spot and two red spots on the dorsum on the tenth segment. Tubercles large and rough, jet black, bearing thick tufts of short bristly hairs. Length, 30 mm.

Food-plant.—Poplar.

This species is easily recognized by the strong contrast between the white ground color and black markings, which gives it a striking appearance. It is not uncommon in this vicinity, and is found from about the middle of May until August. The caterpillar spins a cocoon between leaves on the ground.

Apatela impressa (*Walk.*).

Fore wings ashen gray, more or less powdered with black. Basal and anterior transverse lines geminate, black. Median shade black, distinct, forming an angle on the reniform mark. Posterior line rather strongly dentate outwardly, with a black shade where it curves inward. From the base to the posterior lines is a rather distinct black shading. Subterminal line whitish, broken, and hardly distinct. Orbicular round, small, black-ringed, usually with a black dot in the centre. Reniform large, black-ringed, and obscured by the median shade. Hind wings dirty whitish in the male, smoky in the female. Expanse, 30–37 mm.

Caterpillar.—Head black. Body velvety black, with a broad, diffuse, faint reddish band below the spiracles. Warts pale, somewhat whitish on the central segments, hairs short, in small bunches. On the second to fifth and eleventh and twelfth segments the hairs are somewhat spiny and light reddish brown, elsewhere soft and pale yellowish. Length, 38 mm.

Food-plants.—Plum, blackberry, currant, hazel, willow, etc.

Allied to *A. sperata*, but differs from this species by having the fore wings heavily shaded with black and by the black shade from the base to the posterior line. The markings are also more pronounced, and as a whole the wings are not so uniformly colored. Found in May, June, and July. Possibly two-brooded.

Apatela distans *Gr.*.

Resembles *A. impressa*, but the apices of the fore wings are more pointed, and the markings, on the whole, are less distinct, more suffused by black scales, and there is a blackish longitudinal shading which extends from the base below the middle of the wing to the outer margin without a break. Expanse, 36 mm.

Caterpillar.—Head shining black. Body black, paler at the incisures, and a yellowish band below the spiracles. Hairs short, in small bunches from the warts, the dorsal space appearing somewhat broadly black from the absence of hairs. Hairs pale yellow, soft, a few bristly ones from tubercle i and some black ones on the fifth and eleventh segments. Length, 36 mm.

Food-plants.—Poplar, willow, birch, alder.

Allied to, and often confounded with *A. impressa.*

Apatela xyliniformis (*Guen.*).

PLATE XXXVI, FIG. 11.

Fore wings ashen gray, more or less powdered with black. Basal line in most cases wanting, or obscurely marked on the costa. Anterior line very indistinct and rarely complete, often only marked on the costa by an oblique dash. Median shade marked on the costa by an oblique dash and very rarely traceable across the wing. Posterior line strongly dentate outwardly and followed by a brownish shade. Above the anal angle there is a distinct black streak from the margin and through the posterior line. No basal dash or shade. Orbicular small, reniform larger, both well defined but not contrasting. Hind wings white in the male, dusky in the female. Expanse, 35–45 mm.

Caterpillar.—Head black with a pale V-shaped mark and labrum, or dull reddish shaded with brown, the V mark yellowish. Body varying from blackish to gray, finely strigose and peppered, and dorsal darker shade broken into segmentary furcate patches. Below the spiracles is a broad, diffuse red band, most distinct in the paler forms. Warts nearly in line transversely, iv nearly obsolete, yellowish. A more or less distinct yellowish patch covers warts i and ii on the fifth and eleventh segments. Hairs stiff and spiny, sharp pointed, with a few long, slender black ones at the extremities. The spines are pale with black tip, a few black. In the darker forms the spines on the second to fourth segments are deep red at the base. From warts i to iii on the fifth to ninth segments are small tufts of dense, fluffy, barbuled, conspicuous white hairs. Length, 35 mm.

Food-plants.—Birch, blackberry.

Somewhat variable in size, ground color, and markings. Usually only the posterior line on the fore wings is distinct, and it often sends shoots from the dentations to the outer margin, giving a somewhat streaked appearance. Found in May and June, and late in July and August. Rather common.

Apatela oblinita (*A. & S.*).

Fore wings very pale gray, or almost white, with the markings more or less distinct and strigate, and not contrasting. Anterior and posterior lines zigzag or dentate. Outer part of the wing usually with dark streaks to the margin. Orbicular and reniform spots hardly traceable. Hind wings white in both sexes, with a row of black dots at the outer margin, also present on the fore wings. Expanse, 40–50 mm.

Caterpillar.—Head jet black, shining. Body velvety black with a series of very large, conspicuous patches, or rather a broken band, along each side. Along the subdorsum on each side are small spots in form of a patch, but sometimes the incisures on the second and third, and third and fourth segments are in form of a transverse band. Warts black, with short pale bristle-like hairs. Spiracles white. Sometimes the warts are red and the subdorsal spots form a continuous mottled stripe. Length, 40–50 mm.

Food-plants.—Willow, alder, buttonbush, strawberry, raspberry, *Polygonum*, and various other plants.

This is one of the most common species found in this vicinity. It may be known by its pale color, strigate markings, and narrow wings. It is found from May to August and is double-brooded. The caterpillar spins an elongate, tough cocoon, usually on the under side of boards, fence rails, and stones or amongst leaves.

Arsilonche albovenosa (*Goeze*).

PLATE XXXV, FIG. 14.

Fore wings white, and more or less heavily marked with fawn brown streaks between the veins, giving the insect a very characteristic appearance. Hind wings and body white. Expanse, 34–45 mm.

Caterpillar.—Head black, with an inverted V mark on the face, two white stripes on top, and mottled with white at the sides. Body black, two yellow lines on each side of the back and one on each side below the spiracles. The body is also mottled with confluent striæ, but less so on the dorsum. Warts orange with light and dark bristles; along the extreme sides a row of orange spots. Underside pale whitish. Length, 40–45 mm.

Food-plants.—Willow, smartweed (*Polygonum*), grass, etc.

Rather common locally during certain years. The moth appears in May and June and again in August. Double-brooded. The caterpillar constructs an elongate cocoon, similar to that of *A. oblinita.*

Harrisimemna trisignata (*Walk.*).

PLATE XXXV, FIG. 1.

Fore wings white, with a number of black, transverse, scolloped lines, and a fine blackish shading across the middle; near the base below the costa is a chocolate brown round patch and a similar and somewhat larger one near the apex, and another near the hind angle. Thorax chocolate brown; tufts on the abdomen of the same color. Hind wings white in the male, with a narrow broken outer margin; gray in the female, with the fringes white, and a row of outer spots at the base. Expanse, 30–35 mm.

Caterpillar.—Head black, shining, with a reddish shade in the sutures. Body compressed, higher than wide, feet, especially the abdominal legs, very long. Fourth, fifth, and sixth segments arched and strongly humped, as is also the eleventh segment. Tubercles large, chitinous on the humped parts, elsewhere small, reduced to setæ, all with rather long white hairs. Cervical shield attached to the head by a firm membrane. Color black, shading into reddish brown on the anterior side on the hump and on the eleventh segment and thoracic feet. Sides of segments six–nine streaked and washed with whitish flesh-color, joining over the back centrally. Length, 40 mm.

Food-plants.—Lilac, huckleberry, winterberry (*Ilex verticillata*).

Quite rare in this vicinity and found late in May, June, and July. It may be readily known by the three chocolate-colored round patches on the fore wings. The caterpillar has a frosty appearance, and lives solitary. It bores into soft wood to form its pupa.

Microcœlia diphteroides *Guen.*

Plate XXXV, Fig. 12.

Fore wings pale green, with irregular black transverse lines filled with white. On the costa at the middle is a triangular black patch, more or less connected with the mark in the cell, giving the two a square appearance. Fringes prominently cut by black. Hind wings pale smoky. Expanse, about 33 mm.

Var. OBLITERATA *Gr.*—Plate XXXV, Fig. 17.—In this variety all the black lines on the fore wings are obliterated, leaving the white intervening spaces faintly present. The black mark on costa and very small mark near the base present.

The moth flies during June, July, and August. It is quite common, the variety more so than the type form.

Bryophila lepidula (*Gr.*).

Plate XXXV, Fig. 4.

Fore wings pale green at base, and black from the costa to the transverse, scolloped anterior line, which is black and white. Middle part of wing brown and black. Orbicular and reniform marks large, green, outlined by white and black. Transverse posterior line partly white and black, strongly streaked outwardly and marked by black dots on the veins. Outer part of wing partly brown and green, subterminal line irregular. Hind wings dusky. Expanse, 30–34 mm.

Quite rare in this vicinity, and found during June, July, and August.

Bryophila teratophora *H.-S.*

Fore wings gray brown with two white costal marks, the first opposite the reniform spot, and the second forming part of the subterminal line, which is indistinct. Transverse lines black. Orbicular obsolete. Reniform white, very large, marked with brown, opposite a white dot on the inner margin. Hind wings gray. Expanse, 30 mm.

Rare in this vicinity. June and July.

Chytonix palliatricula (*Gn.*).

PLATE XXXV, FIG. 10.

Fore wings light and dark brown. Basal line distinct, black. Anterior line black, outwardly oblique, straight or a little curved. Posterior line curved around the cell, thence oblique to the inner margin. Subterminal line pale brown, irregular. From anterior to the posterior line, beneath the middle, is a black longitudinal line, ending in a white spot. Beneath this line the wing is dark brown, and light brown above, or white. Orbicular and reniform marks large, pale brown, or white, partly outlined with black. There is also a trace of a median dark shade on the costa between the two spots. Hind wing fuscous. Expanse, 28–34 mm.

Found in May and June and again in July and August. It is not common and may be known by the brown color and the black streak connecting the posterior and anterior lines on the fore wing.

Chytonix sensilis *Gr.*

Fore wings brownish fuscous, with a reddish stain over the subterminal line. Spots somewhat paler; the reniform medially constricted, enclosing a black shade, separated into an upper and lower spot. Transverse lines black, rather wide apart. Transverse posterior line curved around the reniform, thence downward and outwardly oblique, with a slight indentation opposite the cell, thence it runs inwardly to the inner margin. Attached to it is a small white spot. Subterminal line uneven, with an outward tooth at the middle. Hind wings fuscous. Expanse, 31 mm.

Quite rare in this vicinity. It is allied to *C. palliatricula*, but the transverse posterior line is not so rounded opposite the cell, the anterior line not so oblique, waved, with a submedian indentation. The lines do not appear so widely apart in *sensilis* as in *palliatricula.*

Polygrammate hebraicum *Hüb.*

PLATE XXXV, FIG. 9.

Fore wings chalky white with the transverse black lines more or less broken. Orbicular reduced to a small black dot; reniform mark open on upper part. Hind wings pale smoky. Expanse, 25 mm.

A small species, recognizable by the white fore wings with black markings. June and July.

Cerma cora *Hüb.*

Fore wings grayish fuscous, basal and median spaces white with a black, wavy line across the latter. Transverse anterior and posterior lines black, wavy; the former almost erect, the latter curved around the reniform. Orbicular white, black-outlined. Reniform large, black-outlined, and with a central black mark. Fringes black and white. Hind wings blackish, fringes interrupted with white. Expanse, 25 mm.

Very rare in this vicinity.

Rhynchagrotis rufipectus (*Morr.*).

PLATE XXXVII, FIG. 14.

Fore wings gray brown, with a reddish brown tinge in some specimens. Transverse lines more or less distinct, the posterior line followed by a row of small black dots. Orbicular and reniform large, same as the ground color with a darker outline. Head and collar deep velvety brown. Hind wings pale dirty whitish brown. Expanse, 33–37 mm.

Rare in this neighborhood. Found during June, July, and August.

Rhynchagrotis anchocelioides (*Guen.*).

Fore wings vary from drab or clay yellow to dark red brown, with the markings usually indistinct in the pale form. Fringes usually clay yellow. Orbicular and reniform outlined with pale ocherous, center darker. Hind wings varying from dirty pale whitish brown to blackish, with the fringes more or less clay yellow. Expanse, 31–37 mm.

Var. BRUNNEIPENNIS *Gr.*—Fore wings and thorax red brown. Transverse lines present. Orbicular and reniform outlined by pale yellow.

Not common. Taken during July, August, and September. An exceedingly variable species as regards the color of the fore wings.

Rhynchagrotis placida (*Gr.*).

Fore wings dark grayish fuscous, sometimes with a brown tinge, smooth, with the transverse lines geminate and indistinctly visible, somewhat darker than the ground color. Subterminal line with a dark blackish spot at the costa. A terminal row of minute blackish dots. Orbicular invisible or indicated by an outline very slightly darker than the ground color. Reniform distinct, blackish. Hind wings concolorous, fuscous, with the fringes white at the tip. Expanse, 32–34 mm.

Rare in this vicinity, but rather common in the Western States. It is found during July and August, and may be distinguished from *R. anchocelioides*, to which it is closely allied, by the smooth fore wings and white fringes of the hind wings.

Rhynchagrotis alternata (*Gr.*).

Fore wings clay brown heavily irrorate with black. Transverse lines more or less distinct, geminate, usually broken, blackish. Terminal part considerably paler than the rest of the wing, almost whitish, irrorate with black. Fringes dark with a yellow line at the base. Orbicular and reniform darker than the ground color, pale, outlined and somewhat shaded with ferruginous in the center. Hind wings fuscous to blackish, fringes paler, usually clay yellow at base. Abdomen tipped with clay yellow, inclining to roseate in the female. Expanse, 35–38 mm.

A well-marked species, readily known by the pale terminal part of the fore wing. It is common in this vicinity, though not abundant. July, August, and September.

Rhynchagrotis brunneicollis (*Gr.*).

Fore wings reddish gray, slightly irrorate with black, and more extensively with ferruginous scales. Transverse lines dark brown, distinct, interrupted; basal line blackish, nearly straight; transverse anterior line sometimes indistinct, crenulate, forming three even curves; transverse posterior line crenulate, forming black dots on the veins; subterminal line narrow, pale, and indistinct, with a dark costal shade. Spots large, concolorous with the wing, defined by ferruginous rings. Reniform broad, excavated outwardly. Terminal space somewhat darker. A faint narrow ferruginous median shade. Head and collar deep brown; thorax like the wings. Hind wings broad, pale grayish testaceous. Expanse, 35–40 mm.

Not common. The moth is on the wing from June to September.

Adelphagrotis prasina (*Fabr.*).

PLATE XXXVII, FIG. 8.

Fore wings umber brown, more or less densely covered with mossy green shades, giving the insect a very characteristic appearance. In strongly shaded specimens the green, when observed under a lens, forms three broad streaks from the base to the outer margin, and one from the reniform spot, with dashes of the same color between these streaks at the outer part of the wing. All the lines are geminate. Basal line black, partly filled with clear white, as is also the oblique scolloped anterior line. Posterior line lunulate obscured by a distinct white patch at the costa. Subterminal line dentate, irregular, the teeth pointing inwardly. Margin with a row of small lunate black spots. Orbicular and reniform very large, black-outlined. Head and thorax tinged with mossy green. Hind wings fuscous; fringes pale with a greenish tinge. Expanse, 45–50 mm.

Caterpillar.—Head ash gray with two brown spots. Greenish or blue green with a row of spade-shaped patches along the back, broken on the middle by a pale line. On each of these patches are two white dots. Along the sides is a row of black patches and a reddish line along the legs. Spiracles white. Length, 45 mm.

Food-plants.—Blackberry, raspberry, huckleberry.

A large mossy green species, with a large white patch beyond the reniform. The larva may be found in autumn and early in spring. The moth flies in July and August, and is not uncommon. Also found in Europe.

Platagrotis pressa (*Gr.*).

PLATE XXXVII, FIG. 3.

Fore wings dusky gray, shaded with pale green, with the transverse lines geminate, black, and filled with dirty white. Subterminal line with more or less distinct black dashes pointed inwardly. Reniform and orbicular large and black-ringed. Claviform large with the upper edge black. Terminal line narrow, black, and dentate. Hind wings pale, with a pale fuscous median shade and outer margin. Expanse, 34–40 mm.

Easily recognized by the prominent markings, and the pale green shades on the fore wings. Not common.

Platagrotis condita (*Guen.*).

Fore wings whitish gray, with large stigmata and bright brown, contrasting subterminal space. A black basal dash and a second above it on the cell, before the orbicular, which is near the anterior line ; above it, on the costa, are two black lines, rather wide apart, with included space white. Below, the anterior line is twice waved to the inner margin. Basal space whitish ; basal line indicated. Sub-basal space dark gray. Spots concolorous, black-ringed. Orbicular ovate. Reniform moderately excavate. Claviform incomplete. Posterior line narrow, geminate, regularly and slightly scolloped, with a deep incision opposite the cell. Terminal space narrow, gray, with a dentate black line. Hind wings pale gray fuscous ; fringes pale touched with blackish at extremities of veins, and a black terminal line. Thorax gray, dark on the tegulæ. Expanse, 39–42 mm.

Rare and easily known by the large, pale spots on the fore wings. The caterpillar is white with blackish markings, and spins a cocoon not unlike that of *Cerura*. The moth flies in April and May.

Eueretagrotis sigmoides (*Guen.*).

PLATE XXXVII, FIG. 16.

Fore wings of a rich brown with the costa broadly pale brown to the posterior transverse line. Cell before and between the ordinary spots black. Transverse anterior line dentate, obliterated by the black and light shades. Transverse posterior line geminate, lunulate, filled with light brown. Subterminal line similar. Orbicular small, round. Reniform large. Thorax velvety brown in front. Hind wings fuscous. Expanse, 35–40 mm.

Not rare in this vicinity. It flies in June and July.

Eueretagrotis perattenta (*Gr.*).

Similar to *E. sigmoides* in ornamentation, but it is a smaller species, and lacks the creamy shading over the costa of the fore wings, which are rosy brown. Expanse, 32–36 mm.

Not common ; flies during June and July.

Eueretagrotis attenta (*Gr.*).

Fore wings rosy brown with pulverulent lighter shades, especially over the costal region. At the base is a black streak extending to the transverse anterior line. Head and thorax concolorous with the wings. Hind wings pale, with a very narrow dark terminal line. Transverse lines the same as in *E. perattenta*, Expanse, 34–36 mm.

This species very much resembles *E. perattenta*, but lacks the black color in the cell. It is also much paler. Flies in June and July.

Semiophora opacifrons (*Gr.*).

Fore wings gray, often with a reddish tint; cell between the spots more or less black; transverse lines simple, black. Basal line evident. Transverse anterior line nearly even, slightly oblique outwardly. Transverse posterior line strongly crenate, parallel with the outer margin. Subterminal line often obsolete, sometimes indicated by a slightly darker shade. Spots moderate, concolorous, not complete, marked by the blackish cell. Hind wings fuscous, paler towards the base, with a distinct discal lunule. Thorax gray, with the front blackish brown. Expanse, 35 mm.

A distinct broad-winged species, with the cell blackish, the transverse posterior line distinctly crenate, and the apices rectangular. Very rare in this vicinity.

Semiophora elimata (*Gr.*).

Plate XXXVII, Fig. 18.

Fore wings ashen gray, thinly powdered with brown scales, the markings more or less distinct, but sometimes almost obsolete. Transverse anterior line curved around to the orbicular, then with an inward curve, thence with two outward sinuations to the base. Transverse posterior line very strongly curved from the costa to below the middle, then curved inward, crenulate. Subterminal line in form of a brown shade. Cell sometimes filled with brown before and behind the orbicular. Spots distinct. Hind wings pale fuscous. Expanse, 38–45 mm.

A variable species with the markings sometimes almost obliterated. It is not common in this vicinity. Flies early in spring and in September.

Semiophora tenebrifera (*Walk.*).

Fore wings dark and deep red brown, brighter outwardly and at the base below the median vein. The transverse lines are almost obscured by the ground color. Spots gray, contrasting. Orbicular rather large, spherical. Reniform also large, inclosing a black stain. Subterminal line quite distinct, being indicated by a line of powdery gray. Before the margin is a fine gray, wavy line, which appears as interspaced points. Fringe light brown. Hind wings soiled with fuscous, fringes pale ruddy. Thorax like the fore wings; collar above with indistinct pale edging; head rufous, tip of palpi pale. Expanse, 32–34 mm.

A variable species, often irrorate with gray. The wings are narrower than in *S. elimata*, and the apex more obtuse. The moth flies in May and June.

Pachnobia manifesta (*Morr.*).

Fore wings red to rusty brown, more or less irrorate with black scales. The transverse lines are single and well defined. Transverse anterior line in the male vertical, thrice waved between the veins; in the female more even and oblique. Transverse posterior line almost parallel with the outer margin. Subterminal line forming the beginning of a slightly paler terminal shade, its course sinuate. Claviform obsolete. Orbicular punctiform, ill-defined Reniform ovate or somewhat lunate. Hind wings fuscous. Head and thorax concolorous. Expanse, 31–34 mm.

Rare in this vicinity. Flies in May and again in August.

Pachnobia monochromatea (*Morr.*).

Fore wings rusty red brown, sprinkled with black atoms. Transverse lines simple, broad, nearly equal, approximate and evenly curved outwardly. Subterminal line, reniform, and orbicular obsolete. Hind wings paler, reddish fuscous. Head and thorax concolorous. Expanse, 31 mm.

An easily recognized species. The markings are simple and the median lines are parallel. Very rare in this vicinity.

Pachnobia fishii (*Gr.*).

Fore wings reddish purple. Transverse lines not prominent. Anterior line slightly oblique, almost even. Posterior line curved around the reniform, then bent inwardly. Median shade present but very faint. Subterminal line pale, scaled with black and forming a black mark on the costa. A terminal row of black dots. Fringes reddish. Orbicular round, pale-outlined. Reniform filled with pale scales, dusky at the lower part. Claviform absent. Hind wings fuscous with a reddish tinge. Fringes uniform reddish. Head and thorax reddish. Expanse, 33 mm.

Very rare in this neighborhood. Flies in April and May.

Agrotis badinodis *Gr.*

PLATE XXXVII, FIG. 5.

Fore wings broad, red or violet brown, basal and transverse anterior lines darker, narrow, with a distinct dark brown spot on the latter above the middle and touching the orbicular. Transverse posterior line slightly curved outwardly, dark brown, pale outside. Orbicular and reniform large, pale-outlined, with a dark shade between them; this shade runs narrowly across the wing. Beyond the posterior line is a dark brown shade, especially toward the costa. Hind wing fuscous or powdered with reddish and with a distinct dark discal mark. Head and thorax concolorous; collar deep velvety brown. Expanse, 35–39 mm.

A rather common species, easily known by the broad fore wings with the apex pointed. Flies from July to October.

Agrotis violaris *G. & R.*

Fore wings pale lilac gray, sparsely scaled with black; median space darker on outer half. Anterior line evenly oblique, geminate, the inner line vague. Posterior line evenly bent around the reniform, thence oblique to the inner margin. Subterminal line not distinct. Basal line absent. Orbicular concolorous, not distinct. Reniform large, dark ringed, filled with gray black, inner annulus pale. Hind wings smoky gray or dusky, fringes white. Head and thorax pale lilac gray. Expanse, 40 mm.

Very scarce in this neighborhood, occurring in September and October. Easily known by the pale lilac gray fore wings with even transverse lines.

Agrotis ypsilon (*Rott.*).

PLATE XXXVII, FIG. 12.

Fore wings deep purple brown, more or less suffused by pale luteous shades. Sometimes dark to the transverse posterior line, with the subterminal shade ocherous or along the costal region. Anterior transverse line geminate, curved between the veins. Transverse posterior line almost straight, punctiform. Subterminal line strongly dentate inwardly, the two dentations opposite the cell black. Claviform black-outlined. Orbicular rather small, rounded or elongate, black-outlined. Reniform larger, kidney-shaped, outwardly marked by a short black dash. Hind wings dusky or whitish, with the veins dark and with a decided pearly lustre. Thorax violet gray black; collar dark brown. Expanse, 37–53 mm.

Caterpillar.—Head brown, mouth parts black. Body thick and broad, light to dark brown with a pale dorsal line and three pale lines along the sides, the one on the subdorsum more distinct. Each segment with eight shining black piliferous spots and two paler ones at the sides. Underside greenish gray. Neck and anal plates light brown. Length, 35 mm.

Food-plants.—Corn, potato, tobacco, cabbage, plantago, and other low plants.

This is one of the most common species and is found throughout the United States and Canada, and from Mexico southward to Uruguay; also in Europe, India, China, Australia and Africa. It is, in fact, a cosmopolitan species. The larvæ usually live on young plants and have a most emphatic and pernicious cutting habit. They often cut off plants that are six inches in height, generally at an inch above the ground. The moth flies from June to October.

Agrotis geniculata *G. & R.*

Fore wings varying from gray to deep smoky brown. Basal and anterior transverse lines geminate, scolloped, and dentate with the spaces between pale. Posterior transverse line geminate, scolloped, variable in its course, but usually curved outwardly. Subterminal line pale and narrow. Ordinary spots usually pale, with the intervening space in the cell black. Across the wing sometimes a dark median shade, especially in the gray forms. Hind wings varying from gray to smoky brown ; fringes tipped with white. Expanse, 28–34 mm.

A very variable species. In pale individuals the subterminal area is usually the darkest. The transverse lines are always filled with pale gray, in light and dark specimens, which renders them conspicuous. The moth is not common; it flies in August and September, and possibly also early in the season.

Peridroma occulta (*Linn.*).

Fore wings ash gray, more or less powdered with smoky brown. Transverse anterior line geminate, lunate, and usually filled with gray. Transverse posterior line geminate, bent over the cell, thence obliquely inward to the hind margin, dentate outwardly, lunate inwardly. Subterminal line irregular and sending black dashes inwardly, those opposite the cell usually touching the preceding line. Margin with a row of black dots. Orbicular large, dark-outlined, and as a rule filled with light gray and completely closed above. Reniform very large, kidney-shaped. Claviform black-outlined, sometimes followed by a black dash. Basal transverse line evident. Head and thorax like the fore wings in color. Hind wings usually grayish brown with the fringes clear white. Expanse, 50–62 mm.

Caterpillar.—Head brown. Body gray brown with a large black patch on each segment, divided in the middle by a pale dorsal line. On each patch are four white spots. A white subdorsal line touches the black patches. At the side is a white line, above which are black patches, each with two white spots. Spiracles black. Anterior part of last segment with a yellow patch. Length, 60 mm.

Food-plants.—Various kinds of low plants.

A very large species, easily recognized by its gray color, with prominent markings on the fore wings. Superficially it somewhat resembles *Apatela americana.* It is not common and flies in June, July, and August. It is widely distributed, being found in Europe, Greenland, Lapland, Labrador, Canada, and northern United States from the Atlantic to the Pacific. In Lapland, Greenland, and Labrador, the species is said to be paler and smaller.

Peridroma astricta (*Morr.*).

Fore wings red brown, basal and terminal spaces darker. Transverse lines geminate, not very distinct. Basal line scarcely visible. Transverse anterior line evenly and slightly oblique. Transverse posterior line evenly curved over the cell, thence parallel with the outer margin. Subterminal line irregularly dentate, marked by contrast between the subterminal and terminal spaces, the former being darkest, the latter nearer to the ground color. Claviform indefinitely outlined, of good size. Orbicular oblique, oblong; reniform upright, slightly constricted at middle. These spots are large, more grayish than the ground color, and narrowly outlined in black. Hind wings dull smoky brown. Thorax very dark brown. Abdomen same color as the hind wings. Expanse, 50–54 mm.

Very rare in this vicinity, but more common in the Northern States. It may be readily known by its large size and brown color.

Peridroma saucia (*Hüb.*).

PLATE XXXVII, FIG. 7.

Fore wings varying from yellowish brown to dull purplish brown, more or less suffused with black, so as to obscure the markings. Basal and transverse anterior lines geminate, upright, lunate, the former sometimes partly or entirely wanting. Transverse posterior line scarcely distinct, single or double and slightly curved over the cell. Subterminal line indefinite, marked only by a somewhat darker shade, or absent. Orbicular spot round; reniform mark large and kidney-shaped. Hind wings iridescent, smoky brown outwardly; veins marked with brown. Expanse, 40–50 mm.

Caterpillar.—Head light gray, mottled. Body varying from light to dark gray, finely mottled with light brown and very dark brown and black. Eleventh segment with a triangular black or dark brown mark. On the dorsum of each segment, back of the middle, is a more or less bright yellow point, usually brightest on the third, fourth, and fifth. In some individuals these marks are not visible on the posterior part of the body. In the subdorsal region is a series of elongate black or brown spots, in length nearly one half the width of the segment; each beginning on the anterior part of the segment. The space between the dorsal, subdorsal regions, and sides mottled with dark brown, the sides a little paler. Below the spiracles is a yellow or flesh-colored stripe, in the lighter specimens broken into elongate spots. Piliferous spots, each with a short hair, not prominent. Underside grayish, speckled. Length, 30–42 mm.

Food-plants.—Different kinds of low plants, especially in gardens.

Very common everywhere from the latter part of June until November; probably two-brooded. The moth is subject to considerable variation, from ocherous and black to purple brown or grayish brown. The caterpillar enters the ground to pupate. A very widely distributed species, found also in Europe.

Peridroma incivis (*Guen.*).

Fore wings varying from ashen gray to a somewhat reddish gray, irrorate with black scales, terminal part of wing reddish and containing the somewhat paler subterminal line. Transverse posterior line curved and indicated by small black dots; other lines not or scarcely traceable. Orbicular spot round, same as the ground color, or absent. Reniform mark distinct, large, black, annulate with white and ferruginous. Hind wings white, semi-transparent, with a pearly lustre, dusky at the margins. Thorax pale, collar deep velvety brown. Expanse, 32–38 mm.

Not common in this vicinity, but quite so in the Southern States. Found from July to October.

Noctua baja *Fabr.*

Fore wings varying from gray brown to red brown. Transverse lines a little darker than the ground color. Transverse anterior line slightly bent outward. Transverse posterior line evenly bent, with a row of small black dots outside. Subterminal line distinct. Before the apex, a little below the costa, are two black spots, placed close together. Orbicular and reniform evident but not intense in color; the latter marked with black in the lower part. Hind wings fuscous. Expanse, 36–40 mm.

Caterpillar.—Head yellowish red with a curved black line on each side. Body yellowish brown with three fine yellowish lines along the back from the fourth to the end of the eleventh segment, behind which is a white transverse line; on the back of each segment are two black dashes, most prominent toward the last segment. Sides reddish with black irrorations and a reddish gray line below the spiracles. Length, 40 mm.

Food-plants.—Many kinds of low plants.

A very common species, found also in Europe. Flies in July, August, and September.

Noctua normaniana (*Gr.*).

PLATE XXXVII, FIG. 1.

Fore wings rather pale clay-brown gray. Cell, except the spots, deep brown. Basal line present, anterior line slightly oblique, almost straight, very little sinuate. Transverse posterior line geminate, upright and bent over the cell, sometimes with a row of small black dots beyond. Subterminal pale, slightly bent, with black spot on costa. Terminal edge of wing usually reddish brown with a row of blackish lunules at the edge. Median shade present. Orbicular spot pale, oblique, open above. Reniform mark narrow, sublunate, usually incomplete above. Hind wings fuscous. Expanse, 35–40 mm.

A rather common species, found from July until late in September.

Noctua bicarnea *Guen.*

Fore wings slaty black, with a conspicuous flesh-colored patch at the upper part at the base and another patch of the same color on the costa at the beginning of the posterior transverse line. This line is quite ill-defined and is regularly curved outwardly. Basal line black, not running across the wing. Transverse anterior line geminate, partly of the color of the flesh-colored basal patch ; it becomes indistinct below the middle. Subterminal line pale, punctiform, with a small blackish mark on the costa. Cell deep black. Orbicular oblong, slaty black, indistinctly outlined with a flesh-colored ring ; reniform mark narrow, more or less complete, and ringed with black and flesh-color. Thorax pale brown ; collar fleshy or slaty brown. Hind wings fuscous. Expanse, 37–40 mm.

Very common everywhere from July until October. It may be readily known by its slaty black fore wings with flesh-colored patches.

Noctua c-nigrum *Linn.*

Fore wings slaty gray or varying from a light to rather bright fleshy brown with the basal and terminal area slaty gray. Cell black ; costa between the anterior and posterior lines dirty white, brown or carneous. Basal line single, black, ending in a blackish shade. Anterior line geminate, oblique. Posterior line often very indistinct and consisting of small lunules. Subterminal line barely visible, often punctiform, with a distinct black mark on the costa. Orbicular mark open above, V-shaped and forming a part of the pale costa. Reniform mark large, outlined with black and partly filled with reddish brown ; collar and head pale gray brown. Hind wings smoky, paler toward the base. Expanse, 40–44 mm.

Caterpillar.—Head small, shining, with two black streaks in front. Body dull brown, with faint indications of black markings along the back. Upon each of the tenth, eleventh and last segments are two oblique, velvety black streaks. Spiracles white, below which is a rugged line of pale fawn color. Underside pale testaceous. Length, 35 mm.

Food-plants.—Lettuce, cabbage, and other low plants.

Very abundant everywhere, from May until late in the fall.

It is double-brooded and the larva hibernates. Also found in Europe.

Noctua phyllophora (*Gr.*).

Fore wings rather bright red brown with darker shade in some individuals. Basal and anterior transverse lines present, geminate and darker than the ground color. Posterior line somewhat lunate, outer one punctiform. Subterminal line irregular, usually preceded by a darker shade. Orbicular round, outlined with red brown and centered with the ground color; reniform mark similarly colored. Hind wings smoky. Expanse, 37–40 mm.

Readily known by its red brown color and distinct markings and darker shades of red in some individuals. Common everywhere but not abundant. The moth is on the wing from May until late in the season. The larva hibernates.

Noctua jucunda (*Walk.*).

Fore wings pale red brown, varying to yellowish red. The colors are more or less mottled, never entirely even. Basal line distinct, blackish. Anterior line vertical, sometimes not traceable. Posterior line geminate, punctiform and sinuate. Subterminal line distinct, pale and sinuate. Costal patch, before the apex, distinct, red brown. A dusky median shade, most distinct between the spots. Claviform indicated, not completely outlined. Orbicular round, concolorous, pale outlined. Reniform kidney-shaped, usually paler, and more or less suffused with dusky yellowish at the lower part. Hind wing pale yellowish fuscous. Thorax concolorous with fore wings. Expanse, 31–34 mm.

Quite rare and possibly found in this vicinity.

Noctua plecta *Linn.*

PLATE XXXVIII, FIG. 14.

Fore wings bright carmine or lake to deep red brown. Costa from base to the apical third of the wing broadly yellowish or dirty white. A black shade from the base to the end of the cell. Transverse lines absent, sometimes an indication of the transverse posterior line; subterminal line indicated by a light shade. Orbicular small, round, with a small dark center. Reniform mark lunate. Hind wings white. Expanse, 29 mm.

Caterpillar.—Head brown with white dots and two whitish streaks. Body varying from light to dark yellowish gray, or reddish brown, with four black dots on each segment, placed between three dorsal lines; these are dotted with whitish. A white transverse line on the anterior part of last segment. Sides with a reddish line along the spiracles, whitish above and yellowish gray beneath. Underside green gray. Length, 30 mm.

Food-plants.—Chickory, lettuce, celery, and many other low plants.

A small species easily known by the red fore wings, with contrasting pale costa. Also found in Europe. It flies from May to October and is rather common in this vicinity.

Noctua fennica *Tausch.*

Dark blackish brown, inner margin sometimes more or less reddish yellow. Transverse lines more or less distinct. Basal line evident. Anterior line even, inwardly oblique, and somewhat curved. Posterior line crenulate, somewhat sinuate, almost parallel with the outer margin. Subterminal line pale, more or less punctiform, irregularly sinuate, preceded by black sagittate dashes, the two opposite the cell longest. Across the median space is a darker shade. Claviform very narrow, short. Orbicular usually small, sometimes punctiform, oblique, ovate, or oblong. Reniform large, kidney-shaped, shaded at each end with dusky. Hind wings whitish, dark outwardly. Expanse, 40–50 mm.

Caterpillar.—Head dark yellowish brown with a black stripe down the front. Body black, with two yellow stripes on each side, the upper one composed of streaks and dots ; the lower one, near the under side, forms two crinkled lines, which approach each other on the anterior segments and diverge posteriorly. Cervical shield shining black. Spiracles surrounded with black. Underside brownish black. Legs and feet pale brown. Length, 30–35 mm.

Food-plants.—Clover and other low plants.

This species is recorded from New York and is possibly found in this vicinity. It flies in May and June.

Noctua collaris (*G. & R.*).

PLATE XXXVII, FIG. 20.

Fore wings gray brown, sometimes with a purplish tinge. Transverse lines, even, pale gray, the outer one evenly curved and followed by a dark shade. Cell black. Orbicular round. Reniform usually kidney-shaped, both pale ringed. Thorax of the color of the wings. Head and collar deep velvety brown. Hind wings fuscous. Expanse, about 29 mm.

Rather scarce in this neighborhood. Found during July, August, and September.

Noctua haruspica (*Gr.*).

Fore wings almost uniform smoky brown, terminal part somewhat darker. Transverse lines single, usually distinct, blackish. Anterior line scolloped, oblique. Posterior line strongly dentate outwardly. Subterminal line very faint, hardly visible. Orbicular and reniform spots large, outlined by black. Hind wings fuscous. Expanse, about 44 mm.

A very large, broad-winged and plainly colored species, with the markings distinct but not prominent. Found everywhere, but not abundant. July to September.

Noctua clandestina *Harr.*

Fore wings dark smoky brown, sometimes a little darker outwardly. Transverse lines usually very indistinct; anterior line scolloped; posterior line dentate. Orbicular black-outlined, ovate, longitudinal and usually connected with the reniform by a narrow spur. Reniform only partly outlined by black. Hind wings pale, darker outwardly. Expanse, 40–42 mm.

Caterpillar. — Head black with a white line in front resembling an inverted Y, and sides white. Body ash gray, inclining on the back to dirty yellow, finely speckled with black and brown dots. Along the dorsum a fine line of a lighter color, shaded on each side, at the junctions of the segments, with a darker color. Subdorsal line light sulphur yellow, with a band of dirty brownish yellow below. Along the spiracles is a wavy line of a dark shade with flesh-colored markings beneath it. Along each side of the back is a row of oblique black velvety marks. Underside greenish gray. Thoracic feet brown. Length, 35 mm.

Food-plants. — Cabbage, celery, plantago, and many other kinds of low garden plants.

A uniform smoky brown gray species with rather narrow fore wings and with the markings often very indistinct. Common everywhere from May until October. Double-brooded.

Noctua lubricans *Guen.*

Fore wings bluish gray, more or less shaded with dark red and outwardly dark red or blackish. Transverse lines varying to the same extent. Basal line evident; anterior line scolloped, single; posterior line evenly curved outwardly. A distinct median red shade, nearest the posterior line. Orbicular wanting. Reniform obsolete, indicated by two black marks or dots. Hind wings pearly white; collar with a velvety brown band in front. Expanse, 34 mm.

Not common. It very much resembles *Agrotis incivis* in color, but is redder, with the orbicular absent and the reniform only indicated by two black dots. It flies from May until late in the fall.

Feltia subgothica (*Haw.*).

PLATE XXXVII, FIG. 9.

Fore wings dark gray or smoky, costa broadly pale grayish; inner margin, subterminal space, and median vein broadly grayish or whitish. Basal line distinct on costa, outwardly oblique, then inwardly oblique from the median vein, which breaks the line at the middle. Anterior line straight, broken by the pale shades. Orbicular open V-shaped, and connected with the pale costal area. Reniform elongate, with a yellowish center. Outer pale shade crossed by the veins. Fringes pale. Claviform mark very long, black-outlined. Hind wings whitish, dark outwardly in the male, fuscous and a little paler basally in the female. Expanse, 31–37 mm.

Caterpillar.—Head shining black, sometimes speckled with white ; front with a white line like an inverted Y. Body white or ash gray, inclining to yellowish. A whitish dorsal line edged on each side with a dark one. Three lateral dark, broader stripes, the lower one separated by two pale ones. Sometimes an indistinct whitish stripe under the lower one. Cervical shield with white stripes. Underside dull white. Legs varied with smoky brown. Length, 32 mm.

Food-plants.—Corn, lettuce, celery, beans, peas, grasses, etc.

Very common everywhere from early until late in the season. It is usually found in grassy places. It may be known at once by the broad and prominent pale longitudinal streaks, by the pale spots, and by the white hind wings.

Feltia jaculifera (*Guen.*).

Allied to *subgothica* in general appearance, but the color of the fore wings is more uniform and the contrast less distinct. The subterminal is not crossed by the pale dashes on the veins, but these terminate abruptly on the posterior transverse line. Over the wings there is a strong reddish tint, and the hind wings are dusky or paler at the base. Expanse, 30–40 mm.

Caterpillar. — Marked similarly to *A. subgothica*, with the colors darker and less pronounced, the longitudinal lines less conspicuous, and the dorsum of a more decided pale buff color. Length, 30 mm.

Food-plants.—All kinds of garden plants, grasses, etc.

A common species. Found from June until late in the fall.

Feltia herilis (*Gr.*).

Very much like the preceding species but usually darker, the costa and orbicular often entirely concolorous. Hind wings almost uniformly blackish. Expanse, 37–40 mm.

Possibly nothing more than a variety of *F. jaculifera.* The markings are the same, but *herilis* is larger and somewhat more robust. Common from June until October.

Feltia gladiaria (*Morr.*).

Fore wings blackish fuscous, often paler, most evidently so below the middle. Transverse lines indistinct; anterior line geminate, lunate; posterior line even, lunate; subterminal line even, pale, preceded by a pale dash along the median vein. Claviform pale-ringed, elongate; orbicular very small; reniform very large, usually not entirely closed below, but entered by the pale dash along the median vein. Sometimes the spots are connected. Hind wings dirty fuscous or smoky. Expanse, 30–32 mm.

Not common. Somewhat resembles *F. subgothica* in general appearance, but is considerably darker. Usually found in September on goldenrod during the day.

Feltia venerabilis (*Walk.*).

Fore wings smoky brown along the costal region, rest of the wing light brown, with the veins usually darker in the lighter specimens. Transverse lines obsolete. Claviform elongate, black-outlined. Reniform large, black-outlined, and filled with the costal dark shade. Orbicular sometimes not traceable, but when present narrow, elongate, black-outlined, and often connected with the reniform by a narrow neck-like process. Thorax grayish fuscous; collar blackish. Hind wings fuscous. Expanse, 32–38 mm.

Not common and usually found in September on flowers during the day. Easily recognizable by the light and dark fore wings, and the absence of the transverse lines.

Feltia volubilis (*Harv.*).

Four wings varying from light gray brown to reddish or black brown; costal region always darker. Transverse anterior line inwardly oblique to the submedian vein, then with an outward notch. Posterior line more or less distinct, crenulate, evenly curved outwardly. Subterminal line hardly traceable, pale and irregularly dentate. Claviform black-outlined, connected with a black dash from the base of the wing. Orbicular small, more or less ovate; reniform larger, kidney-shape; both are black outlined, the latter with a black dash outwardly. Hind wings varying from whitish to fuscous. Expanse, 32–38 mm.

Not common in this neighborhood. It flies in May and June, and again in September and October.

The pale form has been described as *Agrotis volubilis*, and the dark one as *A. stigmosa*.

Feltia annexa (*Tr.*).

PLATE XXXVII, FIG. 10.

Fore wings clay yellow, with a dark patch on the costa before the apex, and sometimes the lower basal half dark, or the wings are deep purplish black with the costa and outer margin clay-yellow. Transverse lines not distinct, marked by darker points. Transverse anterior line sometimes distinct, geminate, and strongly angulated. Subterminal line pale, strongly dentate. Ordinary spots small, connected by a black dash. Claviform elongate, black-outlined. Hind wings clear white, with a pearly lustre. Expanse, 35–44 mm.

Caterpillar. — Head dark gray, with indistinct pale brownish markings. The triangular frontal piece bordered each side by a dark brownish stripe which continues in an obtuse angle on the vertex, and is crossed by a few transverse lines. A brown stripe below the eye. Body dark gray to almost black, with a slight purplish tinge on the dorsum, and densely covered with very minute blackish granules. Dorsal line very indistinct, and bordered each side by a dusky shade. Subdorsal dark gray, not very distinct. Space below the subdorsal line paler than the dorsum with indistinct dusky marks. On the back two more or less distinct, narrow dusky lines run from the anterior margin of each segment, in an oblique direction to the last piliferous spot. Spiracular line whitish bordered above by an interrupted blackish line. Piliferous spots dusky. Spiracles black. Length, 38 mm.

Food-plants.—Cabbage, corn, dandelion, grass, clover, plantain, cotton, and many other plants.

Not common in this vicinity, but abundant in the Southern States. It flies in June and again in August, September, and October. Probably double-brooded.

Feltia malefida (*Guen.*).

Fore wings pale clay yellow with the costa and a mark on the outer margin smoky black. Sometimes the wings are purplish black with the markings indistinctly visible. Transverse lines irregular and usually not distinct. Anterior line geminate, angulate. Posterior line single, crenulate, with an outward curve. Subterminal line pale, strongly dentate, very near the outer margin. Claviform large and filled with black. Orbicular elongate, bottle-shaped, outlined and centred with black. Reniform large and filled with black. Hind wings pearly white. Expanse, 40–45 mm.

Caterpillar.—Head rather small, yellowish brown, or with larger and smaller dark spots, or marked in front with two brownish oblique stripes. Body pale gray with a greasy aspect. Dorsal line scarcely visible. A more or less distinct, rather broad, dull yellowish subdorsal line, illy defined above, but bordered below by a line scarcely darker than the ground color, but well defined below by a faint narrow pale line. A dusky line along the spiracles and a faint, irregular shade above it. Spiracles large, black, shining. Piliferous spots brown, shining. Cervical shield mottled with brown and a pale median line. First to third segments wrinkled transversly. Underside paler than upper. Length, 35 mm.

Food-plants.—Grass, clover, and different kinds of weeds.

Flies during August and September. Rare in this vicinity, but common in the Southern States.

Porosagrotis vetusta (*Walk.*).

PLATE XXXVII, FIG. 4.

Fore wings very pale ashen gray, slightly powdered with dark atoms. Transverse lines absent; the posterior line indicated by a row of small black spots. Outer margin with a row of small black dots. Orbicular usually absent; reniform indefinite, blackish. Head, thorax, and abdomen concolorous. Hind wings white. Expanse, 35–40 mm.

Not common. Easily known by its pale gray fore wings, with hardly any markings, and by the white hind wings. Flies in August and September, and may be found on goldenrod during the day.

Porosagrotis mimallonis (*Gr.*).

Fore wings bright red brown, or purplish brown, with the transverse lines not distinct. Anterior line upright, angulate. Posterior line with an outward curve. Orbicular round, dusky, with a few yellow scales. Reniform large, dusky, more or less defined. Subterminal usually very obsolete. Hind wings white or marked with fuscous outwardly. Head and thorax like the fore wings. Expanse, 35–45.

Very rare in this vicinity, but more common in the Western States.

Porosagrotis tripars (*Walk.*).

Fore wings pale mouse gray. Anterior line faint, single, and marked with black dots on the veins. Posterior line single, blackish, almost upright, marked by black dots on the veins, followed by pale points. Subterminal line not conspicuous. A black terminal broken line. Claviform wanting. Orbicular very small, in form of a ring or dot. Reniform upright, narrow, pale yellowish bordered with black outwardly. Hind wings pale, shaded with fuscous, and with a terminal broken black line. Thorax shaded with brown. Expanse, 30 mm.

Recorded from New York and possibly found in this neighborhood.

Carneades perpolita (*Morr.*).

Fore wings deep shining brown black with the transverse lines obsolete. Reniform and orbicular concolorous, outlined by black. Hind wings smoky brown, somewhat paler at the base. Head and thorax concolorous. Expanse, 34–37 mm.

Not common. Readily known by its dark color and obsolete markings.

Carneades fumalis (*Gr.*).

Fore wings dark slate gray, with simple, darker transverse lines, usually distinct. Anterior line strongly curved between the veins. Posterior line curved outwardly, strongly dentate. Claviform wanting. Orbicular absent or indicated by a small black spot. Reniform indistinct, dusky, lunate. Hind wings grayish fuscous. Expanse, 30–40 mm.

In general appearance resembles *A. bostoniensis* from which it may be readily separated by the single transverse lines. Rare in this vicinity, but more common northward. Flies in July and August.

Carneades velleripennis (*Gr.*).

Fore wings smoky black, with the markings indistinct or obsolete. Orbicular and reniform large, outlined with black. Hind wings white. Head and thorax like the fore wings. Expanse, 35–38 mm.

Not common. Easily known by the black fore wings and white hind wings. Flies during August and September.

Carneades scandens (*Riley*).

Fore wings pale ashen gray or tinged more or less with reddish or yellow. Transverse line marked by black spots on the costa, or obsolete. Subterminal line prominent, pale, lunulate, preceded by a dusky shade, varying from fuscous to ocherous or red brown. Orbicular small or absent, round, outlined with black or red brown. Reniform more or less distinct, outlined by blackish or reddish, usually with a dusky shade at the lower part. Hind wings whitish with a double outward dusky shade and a dusky discal spot. Head and thorax varying from gray to reddish. Expanse, 29–37 mm.

Caterpillar.—Head tawny, variable in depth of shade, with two spots in front and two eye-spots each side. Body very light yellowish gray, variegated with dirty bluish green in the shape of different sized patches, which are distinctly seen under the lens to be separated by fine lines of the ground color. A well-defined dorsal line and less distinct subdorsal and stigmatal lines; another line still less distinct below the spiracles. Dorsal line frequently with a white line along the middle. Piliferous spots black, those at the sides lighter. Spiracles black. Cervical shield tawny with a small black spot on each side. Anal plate tawny speckled with black. Length, 35 mm.

Food-plants.—Apple, grape, peach, cherry, etc.

Not common in this vicinity. It is subject to considerable variation, from a pale ashen gray to clay yellow or reddish ground color on the fore wings. The moth appears in May and June.

Carneades detersa (*Walk.*).

PLATE XXXVII, FIG. 13.

Fore wings ashen gray to ocherous, with the markings paler; costa in the more deeply colored specimens gray. Transverse lines more or less distinct, geminate. Anterior line angulated between the veins. Posterior line parallel with the outer margin. Subterminal line pale, sometimes with black points inwardly. The area between the posterior and subterminal lines usually pale. Orbicular pale, rounded. Reniform pale, rather large. Claviform ill-defined. Hind wings dusky, fringes white. Expanse, 27–32 mm.

Caterpillar.—Head pale brown, shining, mouth parts pitchy black. Body sordid white, semi-translucent, with three equidistant chalky white stripes along each side, and one along the back. Spiracles black. Cervical shield dirty white. Underside wholly sordid white, semi-translucent. Legs concolorous. Length, 36 mm.

Food-plants.—Maritime grasses.

A pale gray species, common in sandy places, especially near the seashore. Found during the day on goldenrod. It flies in September.

Carneades bostoniensis (*Gr.*).

PLATE XXXVII, FIG. 6.

Fore wings dark lead gray, with the transverse line usually obsolete, but when present, darker, distinctly geminate. A curved median shade. Orbicular and reniform hardly visible. Hind wings of the male white, of the female fuscous. Expanse, 37–43 mm.

Easily recognized by the almost uniform gray fore wings with the markings obsolete. Not common. Flies during September and October.

Carneades messoria (*Harr.*).

Dark gray with a luteous tint, especially in the lighter forms. Transverse lines prominent, geminate, and spots distinct, black. Basal line present. Anterior line oblique, curved between the veins. Posterior line obsoletely geminate in some specimens, crenulate, slightly curved. A dusky median shade. Subterminal line narrow, pale, or almost obscured by the ground color. Orbicular round or oval, black-outlined. Reniform large, black-outlined. Claviform more or less distinct, short. Hind wings of male whitish with darker outer margin, usually wholly fuscous in the female. Expanse, 31–42 mm.

Caterpillar.—Head dirty ash gray, with two darker marks, thick and almost joining at the top, becoming thinner below and diverging toward the palpi. Body dirty ash gray, with lighter and darker shadings. Dorsum pale, inclining to flesh-color, with a darker line along the middle. The sides, particularly along the subdorsal line, are of a darker shade. Piliferous spots and spiracles black. Underside dull ash gray, greenish anteriorly and inclining to yellow under the anal segment. Length, 32 mm.

Food-plants.—All kinds of fruit trees, especially the buds.

Common from June until late in September. The markings are usually prominent and give the species a characteristic appearance.

Carneades insula (*Walk.*).

Fore wings varying from carneous gray to bright rust red brown; terminal space always darker. Cell between the spots black or dark brown. Lines geminate, variably distinct. A short, more or less distinct, black basal streak. Orbicular large, round, black-outlined, annulate with yellow scales. Reniform large, kidney-shaped, annulate with yellow. Subterminal line narrow, irregular, sometimes quite indistinct. Hind wings dusky to fuscous. Head and thorax concolorous with the fore wings. Expanse, 31–35 mm.

Not common in this neighborhood, but more abundant north and west. A variable species in color and markings. The ordinary spots are always large and distinct, contrasting with the dark filling of the cell. The western form, *verticalis*, is much paler, with the hind wings whitish. Found from June until September.

Carneades tessellata (*Harr.*).

PLATE XXXVII, FIG. 2.

Fore wings dark gray to red brown, finely powdered with black. Transverse lines as in *C. insignita*, but less distinct and finer. Subterminal line yellowish, usually distinct. Spots powdered with gray or yellowish. Hind wings fuscous. Expanse, 31–35 mm.

Caterpillar.—Head shining black, inverted V mark white and continuous across the black cervical shield. Body dirty ash gray, sometimes slightly tinged with yellowish. On the back is a white line between two dark ones. On each side are three dark lines separated by two pale ones, the lower one broadest with often a whitish line below the lower dark one. Underside dull white. Length, 30 mm.

Food-plants.—Corn, lettuce, celery, spinach, and other garden plants and weeds.

Very closely allied to *C. insula*, but the cell in *C. tessellata* is less distinctly black. Possibly only a variety of *C. insula*. Found from June until September.

Carneades albipennis (*Gr.*).

Fore wings reddish fuscous to deep brown, with the lines nearly as in *C. insula*. Posterior line usually obsolete. Anterior line geminate, blackish. Spots large, concolorous with the wings, and black-outlined. Hind wings white in the male, fuscous in the female. Expanse, 31–35 mm.

Not common. Resembles *C. insignata*, but the fore wings are brighter brown with the markings much the same, while in the male the hind wings are white.

Carneades ochrogaster (*Guen.*).

Fore wings bright clay yellow suffused with reddish to rusty brown. In pale individuals the more brown or reddish terminal space is fuscous, costa pale or reddish. A black basal dash. Cell dark brown black, defining the spots. Orbicular round, concolorous, open on top. Reniform outlined by clay yellow or black. Basal and anterior lines geminate, sometimes obsolete. Posterior line single, almost dentate, somewhat extended outwardly on the veins. Subterminal line single, pale, irregular, preceded by two dark shades. Margin with a row of black dots. Hind wings fuscous. Expanse, 37–40 mm.

Rare in this vicinity but more common northward. Found in July and August. Easily known by its bright and contrasting colors.

Carneades obeliscoides (*Guen.*).

Fore wings broad, light purplish brown, median space darker; costa to the posterior line whitish or gray. Transverse lines distinct; anterior line geminate, not crossing the costa. Posterior line oblique, slightly crenulate, single.

Subterminal line irregular, pale. A black basal dash. Claviform large, black-outlined, surmounted by a pale streak. Orbicular round, pale. Reniform very large, pale, with black outline. Hind wings whitish to fuscous, often paler towards the base. Expanse, 31–38 mm.

Rare in this vicinity. Flies during July and August. May be recognized by its broad wings, pale large spots, whitish costa and bright colors.

Carneades redimicula (*Morr.*).

Fore wings gray, terminal and median space darker. Cell and basal dash deep black. Anterior line geminate, outwardly oblique, with three curves. Posterior line distinct but not prominent, curved around the cell, thence inwardly oblique. Subterminal line marked by the difference in shade of the subterminal and terminal shades. Claviform black. Orbicular light gray, large, black-outlined. Reniform gray, large. Hind wings fuscous, sometimes paler basally. Expanse, 30–34 mm.

A small species, easily recognized by its contrasting gray fore wings, black cell, and basal dash. The spots are large, light gray, and predominating. It is not rare, flying during July and August.

Anytus privatus (*Walk.*).

PLATE XXXVIII, FIG. 3.

Fore wings ashen gray, clouded with fuscous. Transverse lines geminate, included space whitish. Basal half line present. Anterior line outwardly oblique, angulated. Posterior line dentate, rounded above, thence inwardly oblique, with an outward tooth above the inner margin. Both these lines are connected below the middle by a black line. Subterminal line composed of an irregular, distinct, blackish shade. Orbicular rounded, concolorous. Reniform a little larger. A terminal row of black lunate dots. Median space more or less shaded with smoky brown. Hind wings dirty white, a little dusky outwardly, and a terminal black line. Head and thorax gray, mixed with fuscous. Expanse, 35–40 mm.

Common, but not abundant. The moth flies during July, August, and in September.

Psaphidia resumens *Walk.*.

Fore wings ash gray, varying to dark, smoky, or almost black gray in pale specimens, with a greenish wash. Lines incomplete, usually well marked. A black basal dash, looped beyond the anterior line, and filled with white ; below the basal dash, powdered with white. Posterior line acutely projected outwardly below the costa, inwardly oblique, forming an acute angle above the inner margin and almost touching the claviform. Beyond this line the wing is usually white, with the subterminal line indistinct. A black dash above the hind angle. A row of terminal black dots. Orbicular large, round, white, touching the white in the claviform. Reniform large, pale whitish with a brown lunule. Hind wings dirty whitish brown, a small discal spot and median line fuscous. Thorax blackish, mixed with white. Expanse, 35–40 mm.

Rather rare, and flies in April. Allied to *P. grotei*, but not so dark ; the reniform is better defined and less contrasting, and the subterminal area is whiter.

Psaphidia thaxteriana (*Gr.*).

Allied to *P. resumens*, but smaller, with the wings more pointed. In color more uniformly fuscous to the subterminal line, with the subterminal space grayish white. The black dash opposite the angle absent. The ordinary spots ill-defined, whitish. Reniform inwardly margined with black, smaller than in *resumens*. Orbicular rounded, black-edged. Claviform small, concolorous, black-edged, and separated from the orbicular. A fine black basal ray ; no shading across the median space, opposite the claviform. Lines resembling those of *resumens* distinctly marked with black. Hind wings smaller, pale fuscous, with traces of a double line on the veins and a faint terminal line, not broken with points. Thorax hoary gray, tegulæ black-lined. Expanse, 35 mm.

Caterpillar.—Head luteous brown, dotted with white, a black patch on each side of the clypeus with a brown shade on the angle of the lobe, and extending upward on the posterior edge of the lobe, widening above to suggest an elliptical pale enclosure on the side. Body vinous brown, tinted slightly with green. A series of large subdorsal, creamy white patches on segments two to fourteen, and covering the sides of the cervical shield and the whole of the anal plate. Tubercles and spiracles white.

Food-plant.—White oak.

Very rare in this neighborhood. The moth appears in April and early in May. The larva may be found in June. Pupates in the earth.

Psaphidia grotei (*Morr.*).

PLATE XXXVII, FIG. 11.

Fore wings blackish or dark smoky gray, with mossy green shadings unequally distributed over the surface. Anterior line geminate, black, outwardly oblique, irregular, variably distinct. A curved black basal dash looped beyond the anterior line to form a broad claviform. Over this streak and in the claviform some times more orless white. Posterior line geminate, black, faintly distinct, widely outcurved over the reniform, then deeply indrawn, touching the reniform below, reaching the inner margin opposite the space between the ordinary spots. A blackish shade between the spots, reaching the inner margin about the middle. Beyond this shade a white blotch extends along the inner margin, becoming bluish and prominent beyond the posterior line. Subterminal line broken, irregular, mossy green or yellowish, with a deep sinus on vein two, below which it is prominent and crossed by a black dash. Veins more or less marked with black. A broken terminal line, marked by blue powdering around the veins. Orbicular round, concolorous, with a white central dot and a whitish annulus. Reniform large, diffuse, usually white, contrasting. Hind wings white, marked with black on the veins and over the outer margin beyond a broken median line. Head and thorax blackish or deep brown, the latter white powdered on the patapa. A little white tuft at base of antennæ. Expanse, 38–41 mm.

Varies considerably in intensity of color. The mossy green tint is often very distinct. The transverse lines are not usually traceable, and the large indefinite reniform is always contrasting. Flies in April and early in May. Quite rare in this vicinity.

Eutolype rolandi *Gr.*

Fore wings dark ash gray, sometimes almost blackish, with the markings indistinct. Anterior line geminate, outwardly oblique. Posterior line bent inwardly below the middle. Subterminal line irregular, wavy, usually composed of a series of blackish dots, sometimes nearly connected, not distinct. Claviform not traceable. Orbicular round, concolorous. Reniform large, upright, slightly constricted in the middle, concolorous, imperfectly ringed with light and dark. A terminal row of blackish dots. Hind wings dirty white, dusky outwardly. Thorax gray with a metallic tuft posteriorly. Expanse, 31–37 mm.

Easily recognized by the rather narrow gray fore wings with the markings quite obsolete. The moth flies in April and May. Very rare.

Eutolype depilis (*Gr.*).

Fore wings smooth, dark gray. Anterior line fine, black, projected opposite the claviform, which is tinged with yellowish. Claviform moderate, somewhat rounded and incompletely black-ringed. Posterior line fine, irregular, waved. Subterminal line with flecking of yellow outside. Orbicular spherical, gray, with a paler ring edging the faint annulus within. Reniform similar, large, constricted in the middle. Hind wings whitish, with gray edging and fringes. Head and thorax gray, the latter without a metallic tuft. Expanse, 35–40 mm.

Recorded from New York and possibly found in this vicinity.

Mamestra nimbosa (*Guen.*).

Fore wings whitish, more or less powdered with blackish scales. Transverse lines black, geminate. Anterior line lunulate between the veins. Posterior line very strongly dentate outwardly on the veins, lunulate inwardly between the veins. Subterminal line strongly dentate, usually with black dashes inwardly. Margin with a row of black spots. Spots very large, pale, and black-ringed. Thorax whitish or gray with a black line in front; patagiæ margined with black. Hind wings fuscous, with a pale median shade. Fringes whitish. Expanse, 48–58 mm.

A very large, pale, whitish or grayish species with distinct markings. Not common. The moth appears in June, July, and August.

Mamestra imbrifera (*Guen.*).

Fore wings dusky gray, with brown scales, the lines and spots distinct. Anterior line lunulate, outwardly oblique. Posterior line lunulate, slightly incurved. Subterminal line almost even, marked by blackish brown shades. Spots very large, dusky, outlined in black. Claviform brownish, very large, loop-like. Hind wings dusky, with a narrow, paler median line; fringes dirty whitish. Thorax mottled with brown. Expanse, 45–52 mm.

Allied to *M. nimbosa*, but considerably darker. The claviform is much larger, the subterminal line more even, and the antennæ of the male have the pectinations much longer. Common, but not abundant in this vicinity. It is on the wing from about the middle of June until about the middle of August.

Mamestra purpurissata (*Gr.*).

Plate XXXVIII, Fig. 17.

Fore wings pale purplish gray, tinged with blackish along the costal region and reddish on the discal space. Transverse lines faintly indicated. Subterminal line distinct, irregular, somewhat dentate, forming a rather prominent notch near the hind angle of the wing shaded with blackish brown inwardly. Spots large, outlined by purplish black. Claviform small, hardly visible. Outer margin with a row of black lunulate spots. Hind wings fuscous; fringes paler. Head and thorax purplish gray, the latter with a prominent crest, anteriorly. Expanse, 45–58 mm.

Not common. May be known at a glance by its large size, purplish gray fore wings, with darker costal region and prominent subterminal line. Flies during July and August.

Mamestra meditata (*Gr.*).

Fore wings deep reddish brown, with bluish scales. Transverse line indistinct, sometimes barely traceable, or relieved by a pale included space. Reniform and orbicular concolorous, often hardly traceable. Hind wings brown with the tips of the fringes pale. Head and thorax deep brown. Expanse, 27–35 mm.

Rather common, and readily known by its almost uniform dark wings with very indistinct markings. Found during May and June, and again in August and September.

Mamestra lustralis (*Gr.*).

Fore wings pale lilac gray, median space somewhat ocherous. Transverse lines evident, but not distinct, filled with a light shade. Posterior line with a rather prominent tooth near the inner margin. Subterminal line wavy, pale, with an ocherous spot near the hind angle. Claviform rarely complete. Orbicular rounded, with a light gray and black outline. Reniform rather narrow, pale, and outlined with black. Fringes broad. Hind wings dusky, sometimes with a somewhat darker median shade. Expanse, 27–33 mm.

Quite rare in this vicinity. A small species, recognizable by its pale lilac gray fore wings with paler shades in the transverse line. Flies in July and August.

Mamestra detracta (*Walk.*).

Fore wings brown to blackish with a yellowish suffusion. In dark specimens the transverse lines are indistinct, in light ones geminate, black-margined. Anterior line upright, lunulate. Posterior line parallel with the outer margin, not curved, lunulate inwardly. Subterminal line pale, always visible, irregular. Margin with a row of pale dots. A black dash at the base of the wing. Claviform filled with black and prominent, usually followed by an ocherous spot. Orbicular paler than the ground color, black-margined. Reniform large, black-margined, lighter than, or as dark as, the ground color. Hind wings fuscous. Head and thorax like the fore wings. Expanse, 27–35 mm.

Rather rare in this vicinity. Appears in May, June, and July. A medium-sized brown species with the transverse lines more or less distinct, and a prominent black claviform.

Mamestra distincta (*Hüb.*).

Fore wings whitish gray with a darker, usually smoky black median shade above the claviform and in the subterminal and terminal spaces. Basal space pale. Anterior line oblique, evenly curved. Posterior line slightly curved and gently bent inwards at the middle, almost parallel with the outer margin. Subterminal line obsolete, marked by a few black points, especially at the middle. Claviform dark, broad, outlined with black, and sending a black dash to the posterior line. Orbicular large, round, whitish gray, black-ringed. Reniform gray, outwardly white, indistinctly black-outlined. Hind wings white, dusky outwardly. Expanse, 35–37 mm.

Caterpillar.—Head small, almost uniform green. Body green, marked with greenish white. A very faint dorsal line, bordered on each side with a darker shade of green. Subdorsal line distinct. Spiracular line faint; body irregularly mottled with small dots of the same greenish white tint. Length, 32 mm.

Food-plant.—Grape.

A pale whitish gray species with a dark median shade above the claviform, and on the outer parts. The claviform is broad and sends a black streak to the posterior line. Not common in this vicinity. It flies in April and May.

Mamestra capsularis (*Guen.*).

Fore wings fuscous with gray and black shading. Transverse lines geminate. Basal line present, inner portion darkest. Anterior line upright, slightly irregular, the outer part heavier and darker than the inner; included space concolorous. Posterior line exserted over the reniform, strongly incurved below, narrowing the median space by one half, the inner part of line darkest and broadest. Subterminal line narrow, pale, partly obsolete, marked by three preceding and one following sagittate black dashes which define the ≲-shaped mark. Orbicular large, round, bluish white, outlined with black. Reniform upright, hardly constricted, concolorous. Claviform concolorous, black-outlined and extending nearly across the median space. An oblique bluish white shade through the subterminal space, distinct at apex and hind margin, or obsolete. Hind wings smoky fuscous. Expanse, 32 mm.

Rare in this vicinity. A well-marked species, which cannot be easily confounded with any other.

Mamestra atlantica *Gr.*

Fore wings marbled with ocherous and brown, with the costa grayish, varying from light to dark. Terminal space darker. Transverse lines incomplete, sometimes almost absent. Transverse line, when present, white or brown, lunulate. Transverse line narrow, lunulate, and parallel with the outer margin. Subterminal line whitish or ocherous, preceded by a dark shade; at about the middle it forms a prominent ≲, the points reaching the outer margin. A terminal row of black lunules. A narrow black basal streak, not reaching the anterior line. Claviform rather large, dark, with a black outline. Orbicular round, pale or dark. Reniform elongate, large, light or dark, crossed by a dark shade at the lower part. A more or less defined pale shade, from the apex through the subterminal space. Hind wings fuscous, paler basally; fringes somewhat pale. Expanse, 30–35 mm.

Not common. Appears in June, July, and August. In general appearance it looks somewhat like *M. subjuncta*, but is more marbled.

Mamestra subjuncta (*G. & R.*).

Fore wings brown, somewhat shaded with reddish brown, especially above the basal black streak and beyond the reniform. Anterior line composed of three curves, geminate. Potserior line strongly curved outward and incurved below the middle. Subterminal line distinct, pale, with a prominent ⩽ at the middle, marked by black points. A terminal row of small black spots. Claviform large, black-outlined, connected with the posterior line by a black streak. Orbicular large, round, black-ringed. Reniform kidney-shaped, bordered with black. Hind wings fuscous. Expanse, 38–42 mm.

Caterpillar.—Head light shining brown with two outwardly diverging darker marks. Body fleshy gray, inclining to rust-color, finely sprinkled in the middle of each segment with very minute black and white specks. An interrupted white dorsal line and a similar subdorsal line, these being distinct on the posterior part and indistinct on the anterior part of each segment. A stripe along the side lighter than the general color of the body. On top of each segment are two distinct spots anteriorly. Cervical shield with three white lines and the anterior edge white. Legs and end of body greenish. Length, 40 mm.

Food-plants.—Cabbage and other vegetables, etc.

Allied to *M. atlantica*, but usually darker and more uniform in color, with a black streak from the claviform to posterior line. Found during May, June, July, and August. Rather common.

Mamestra grandis (*Bdv.*).

Plate XXXVIII, Fig. 9.

Fore wings fuscous, somewhat reddish brown, with a broad bluish-white shade between the posterior and subterminal lines, and somewhat irrorate with bluish gray. Lines indistinctly geminate, blackish; the included space pale. Anterior line outwardly scolloped. Posterior line lunulate, parallel with the outer margin. Subterminal line whitish, shaded with dark brown black; at the middle it forms a prominent ⩽. A black basal dash and a black streak between the two lines. Orbicular pale reddish brown centrally. Reniform large, colored like the orbicular. Hind wings fuscous, with a narrow dark marginal line. Expanse, 36–42 mm.

Caterpillar.—Head light shining brown, somewhat mottled. Body dull purplish, with obscure black and white mottling. Obscure dorsal and subdorsal lines, and a broad, ill-defined light lateral band. Four dorsal black spots on each segment except on the first to third, the anterior pair being more closely approximate than the posterior. Cervical shield dark; underside greenish. Legs and thoracic feet dull greenish, the latter tipped with brown. Length, 40 mm.

Food-plant.—Burdock.

May be readily known by the oblique bluish white shade on the fore wings, and the rich brown colors. Flies in June and July, and in August to October. Not common in this vicinity.

Mamestra trifolii (*Rott.*).

PLATE XXXVIII, FIG. 4.

Fore wings varying from pale to dark luteous, irrorate, gray, with the markings distinct, but not contrasting. Basal line present. Anterior line outwardly oblique, lunulate. Posterior line slightly sinuate, finely crenulate. Subterminal line pale whitish ocherous, irregular, with the usual ≶-mark distinct, preceded by ocherous or blackish streaks. A terminal row of black lunate spots. Fringes dark, cut by ocherous streaks. Orbicular round, usually pale, black-ringed. Reniform large, blackish at the lower part. Hind wings pale to a little beyond the middle, then dusky; fringes pale. Head and thorax concolorous with the fore wings. Expanse, 30–38 mm.

Caterpillar.—Head pale green. Body green with a dark dorsal line and a white line along the spiracles. Piliferous spot indistinct. Underside uniform green. Length, 25 mm.

A very common species, found from May until late in September or early in October. It is very widely distributed throughout the United States and Europe. Often found flying late in the afternoon about flowers.

Mamestra rosea *Harv.*

PLATE XXXVIII, FIG. 7.

Fore wings reddish testaceous to the subterminal line, beyond which the wings are dark red brown. Transverse line single, red brown. Anterior line irregularly curved. Posterior line crenulate, slightly curved outwardly. Orbicular small, round, brown-ringed. Reniform large, upright, marked with black at the lower part, brown-ringed. Claviform more or less distinct, broad, brown-ringed. A rather broad more or less distinct dark median shade. Subterminal line very irregular. Head and thorax deep red brown. Hind wings pale, reddish fuscous outwardly. Expanse, 40–43 mm.

Not common in this vicinity. Easily known by its color and simple markings. Flies in May and early in June, and again in July.

Mamestra congermana (*Morr.*).

Fore wings carmine brown, tinged with yellowish brown, especially near the markings, which are obsolete. Orbicular very small. Reniform large, black and ocherous, hardly distinct. Subterminal line somewhat indicated by a yellowish shade. Fringes cut with yellowish brown. Hind wings pale at base, dusky outwardly. Head and thorax carmine brown, the latter with an ocherous brown line along the middle. Expanse, 35–40 mm.

Quite rare in this vicinity. Flies in May, June, July, and probably again later in the season.

Mamestra rubefacta (*Morr.*).

Fore wings uniform carmine brown with the markings obliterated. Hind wings pale, darker outwardly. Head, collar, and thorax broadly ferruginous along the middle, sides of thorax carmine brown. Expanse, 37–40 mm.

Rare in this vicinity. It may be known by the uniform red-brown fore wings, with the marking almost or entirely wanting. Appears in May and June.

Mamestra picta *Harris.*

PLATE XXXVIII, FIG. 13.

Fore wings light or dark deep red brown, especially along the costal region, with a carmine tinge; beyond the reniform and below the middle to the inner margin usually tinged with ocherous. Transverse lines obsolete. Subterminal more or less distinct, very irregular in outline, pale. Orbicular very small, pale-ringed. Reniform variable in shape, large, pale-ringed, with dark center, the inferior angle usually produced inwardly. Claviform imperfectly marked by pale scales. Hind wings white, sometimes narrowly edged with brown. Head and thorax uniform carmine brown. Expanse, 35–42 mm.

Caterpillar.—Head reddish brown. Body black, with a broad light yellow band on each side of the back and another below the spiracles. The two yellow bands are connected by narrow bright yellow transverse lines. Back deep black. Below the lateral line the body is mottled with yellow and black. Underside yellow. Length, 55 mm.

Food-plants.—Corn, peas, beans, burdock, yellow dock, smartweed, sweet clover, etc.

Very common everywhere from June until September. A well-known and easily recognizable species. Double-brooded.

Mamestra cristifera (*Walk.*).

Fore wings dark gray brown, irrorate with darker scales, and with variably distinct rufous, flesh, and lilacine tints. Transverse line present, but not contrasting against the dark ground color. Basal line present. Anterior line almost upright, composed of three equal curves. Posterior line almost parallel with the outer margin, crenulate. Subterminal line very irregular, pale ocherous, with lilaceous scales, usually preceded by a narrow brown shade; between this and the posterior lines is a lilaceous shade, forming a clear large patch near the hind angle. Orbicular small, round, lilac, with a dark central spot and black outline. Reniform upright, whitish ocherous with an elongate dark mark centrally. Outer margin with a row of small, black, lunate spots. Hind wings ocherous brown or smoky brown. Expanse, 40–48 mm.

Not common. Found during May and June. May be known by the dark fore wings, pale discolorous reniform, the lilaceous patch near the hind angle, and the rufous shade before the subterminal line.

Mamestra assimilis *Morr.*

Fore wings deep smoky brown black. Transverse lines very indistinct, single. Subterminal line composed of white dots. A rather prominent whitish spot near the hind angle. Claviform, orbicular, and reniform outlined with black, but not contrasting. Hind wings soiled whitish, smoky brown outwardly and with an elongate mark at the end of the cell. Head and thorax uniform brown black. Expanse, 33–38 mm.

Caterpillar.—Head reddish brown. Body thickest in the middle, tapering slightly to each end. Dorsal space reddish brown, shading to dull red on the subdorsal. Along the dorsum a bright yellow stripe, with a narrow creamy white one adjoining it on each side. Along the spiracles a bright yellow stripe, with a creamy white stripe adjoining it above and below, the latter edged with black. Length, 30 mm.

Food-plant.—Goldenrod.

The brown black fore wings and subterminal line composed of white spots and the black-ringed spots will serve to at once distinguish this species. Very rare in this vicinity. The moth flies in June and July.

Mamestra latex (*Guen.*).

PLATE XXXVIII, FIG. 1.

Fore wings whitish gray tinged with darker gray. A dark gray or blackish patch on the costa between the basal and anterior lines, and an oblique blackish shade from the costa and between the spots. Transverse lines geminate, faint. Anterior line upright. Posterior line rather strongly bent inwardly in the middle. Subterminal line marked by the difference in shade of the subterminal and terminal spaces. Terminal space with three black dashes on the upper part and one on the lower part, above the angle. Orbicular large, concolorous with the pale ground color with slightly darker outline. Reniform very large, outlined with black, gray with reddish brown central mark. Claviform black-outlined. Hind wings dusky or luteous gray brown. Thorax gray, usually with a black line along the middle. Expanse, 38–45 mm.

A light whitish gray species, with an oblique blackish shade between the large spots, and black outer dashes. It is not uncommon, flying in May, June, and July.

Mamestra adjuncta (*Bdv.*).

PLATE XXXVII, FIG. 19.

Fore wings black with white contrasting markings. Basal line black, white on each side, not reaching the inner margin. Anterior line black, scolloped, marked with white on the costa. Posterior line almost parallel with the outer margin, filled with a little white in some specimens. Subterminal line rather broad, very irregular, dentate, white, marked with black inwardly. Terminal row of spots black, marked with white inwardly. Orbicular white, center smoky black. Reniform large, white, with a dark central line. Hind wings blackish fuscous, somewhat paler basally, and with a marginal row of blackish spots. Head and thorax blackish; the latter marked with white. Expanse, 32–40 mm.

Caterpillar.—Body green. On each segment is a semicircular dark green dorsal line, concave anteriorly; segments 4, 5, and 11 marked with olive green. A pale spiracular line, giving off a line to the back of each abdominal leg. Last segment elevated in a hump. Sometimes the larva is cinnamon brown with a large subdorsal velvety dark brown shade on the fourth, fifth and eleventh segments and on each of the remaining segments except the first three and the last. A dorsal curved line, two roundish spots of the same color, and two larger square dark brown dorsal spots edged with yellowish. Spiracles white, edged with brown. Underside brown. Length, 35 mm.

Food-plant.—Common brake (*Pteris aquilina*).

Not common. Found in June, July, and August. The black color and contrasting white markings will serve to at once distinguish the species.

Mamestra legitima (*Gr.*).

Fore wings blue gray, more or less suffused with red brown, especially on the upper part of the wings and terminally. Basal line evident. Anterior line slightly bent outward. Posterior line almost parallel with the outer margin or slightly bent inward at the middle. Subterminal slightly dentate, pale, preceded by a narrow reddish brown shade, and followed by the dusky or red brown terminal shade. Claviform black. Orbicular not distinctly defined, gray, sometimes open at the lower part. Reniform large, distinctly defined, red brown, dusky at the lower part, with a pale ring. Two rows of minute black dots through the subterminal space. Hind wings luteo-fuscous, dark outwardly, fringes paler. Expanse, 33–38 mm.

A common species, readily known by its gray and red brown colors. The moth flies in June, July, and August.

Mamestra lilacina *Harv.*

Fore wings bluish gray, shaded with reddish brown or brown black along the upper part of the wing except at the apex. Terminal space dusky. Basal line present. Anterior line lunate, outwardly oblique. Posterior line crenulate, parallel with the outer margin. Subterminal line almost even, pale, preceded by a narrow red brown or dusky shade. Orbicular oblique, blue gray. Reniform rather large, constricted at the middle, dark-outlined, dusky at the lower part. Claviform dark-outlined. Hind wings luteo-fuscous, dark outwardly. Expanse, 32–36 mm.

Allied to *M. legitima*, but may be readily separated from this species by the almost even subterminal line. The color is also more uniform, with a variable amount of dark shading on the fore wings. Flies in July, August, and September.

Mamestra goodelli *Gr.*

Fore wings shiny reddish brown, with the terminal space and costal region slightly shaded with greenish. Transverse lines geminate, rather indistinct and slightly lunate. Posterior line prominently exerted. Orbicular small. Reniform moderate, ill-defined, outwardly shaded with whitish. Subterminal line not prominent. Hind wings fuscous, fringes pale. Collar greenish, edged with black. Thorax reddish brown with the tegulæ dark margined. Expanse, 30 mm.

Not common in this vicinity.

Mamestra ectypa *Morr.*

Fore wings rich, dark umber brown, with a violet tinge in front of the transverse anterior and behind the posterior lines. Basal line distinct, double, absolutely geminate. Anterior line almost even, outwardly curved with a strong indention near the inner margin. Posterior line lunulate, nearly parallel with the outer margin. Subterminal line contrasting, pale yellow, sinuate, marked and preceded by dark spots. A terminal row of black lunules. Orbicular rather large, oval, oblique, pale-ringed with a somewhat darker center. Reniform rather long, a little oblique, black-ringed, concolorous or somewhat paler. Claviform black, outlined and followed by a pale shade which extends obliquely upward over the orbicular to the costa. Hind wings smoky brown. Expanse, 27–30 mm.

Very rare in this vicinity. Known by its bright colors and prominent subterminal line.

Mamestra renigera (*Steph.*).

PLATE XXXVIII, FIG. 8.

Fore wings light or dark purplish brown, with a mossy green basal streak to the anterior line, and a black spot on the inner margin near the base. Transverse line narrowly geminate. Anterior line almost straight. Posterior line usually forming an angle opposite the cell. Subterminal line marked by the contrast of the subterminal and terminal spaces. A large mossy green spot in the lower part of the subterminal space. Claviform large, black. Orbicular more or less distinct, round, small, black-outlined. Reniform upright, narrow, mossy green, white-ringed; whitish, darker outwardly, in the male, darker in the female. Expanse, 25–30 mm.

Caterpillar.—Head dark brown with a narrow stripe in the middle and a broader one at the sides. Body dark fawn brown with a pale narrow dorsal line, and on each segment, dorsally, a brown diagonal shade, on the apical points of which are two small shining black tubercles. The marks on the last two segments are triangular. A broad and decided black lateral line above the spiracles, and beneath this, enclosing the spiracles, which are black, is a waved double line of pale brown; below this again a pale fawn-colored corrugated fold. Underside dull stone drab. All the feet are black at the base. Length, 25 mm.

Food-plants.—*Cichorium intybus*, and many other garden plants and weeds.

Very common everywhere in this neighborhood, and is on the wing from June to September. Double-brooded. Readily distinguished by the purplish-brown fore wings, mossy-green markings, and white-marked reniform.

Mamestra olivacea *Morr.*

Fore wings gray to brown gray, usually more or less suffused with olive green ; terminal and subterminal space usually whitish, with olive green ; median space darkest. The dark brown specimens usually have a pinkish shade in the basal area and in the lower part of the subterminal space. Lines black. Anterior line with an even, somewhat oblique outward curve. Posterior line outwardly curved over the reniform and inwardly curved beneath, the included space pale, and the outer portion of this line often indistinct. Subterminal line more or less evident, pale. Orbicular usually obscured by the ground color, small, round. Reniform whitish, with a greenish or dusky center. Hind wings light or dark fuscous. Thorax often discolored, white. Expanse, 23–26 mm.

Not common in this vicinity, but rather abundant in the Northern States. Flies from June until September.

Mamestra rectilinea *Smith.*

Similar to *M. olivacea*, from which it differs in having the posterior line evenly oblique and the anterior line more irregular. The maculation is more powdery and there is never so much contrast in the subterminal space, with a prominent paler patch in this space near the hind angle. Expanse, 25–28 mm.

Recorded from New York and possibly found in this vicinity.

Mamestra laudabilis (*Guen.*).

PLATE XXXVIII, FIG. 2.

Fore wings pale sea-green, with the median space blackish, or marked with reddish, especially in the cell between the spots and before the orbicular. Basal line geminate, black, included space whitish ; sometimes broken, rarely wanting. Anterior line black, inner line often absent, included space whitish, in its lower course a strong inward dent. Posterior line black, crenulate, included space whitish, followed by a series of venular dots indicating the outer course of the line. Subterminal line whitish with a series of black dots. Above the angle sometimes a dusky patch. Fringes white with a row of black dots. Orbicular small, round, outlined in black. Reniform oblong, green, outlined in black. Claviform variable, black outlined. Hind wings whitish, darker outwardly. Expanse, 25–30 mm.

Quite rare in this vicinity. The moth appears in May and June, and again in July and August. It is probably double-brooded.

Mamestra lorea (*Guen.*).

Fore wings ocherous with the median space considerably darker, rather sharply defined. Transverse lines single. Anterior line upright, angulate between the veins, sometimes a little oblique. Posterior line outwardly bent over the reniform, then oblique to the inner margin. Subterminal line wavy. A fine terminal brown line. Spots not very distinct, brown-ringed. Hind wings luteo-fuscous. Head and thorax ocherous brown. Expanse, 25–31 mm.

Caterpillar.—Head black with dirty whitish, irregular markings; antennæ pink. Body dirty creamy brown, except the first three segments, which are blackish. Along the dorsum is a series of lozenge-shaped blackish patches, one on each segment; also two rows of minute piliferous spots and two rows along each side, where there is also on each segment an ill-defined, oblique blackish stripe. Underside translucent white. Thoracic feet pale brown. Length, 35 mm.

Food-plants.—Strawberry, wild geranium, etc.

Common, but not abundant. Easily known by the ocherous brown fore wings with darker median space. Flies from the latter part of May until July.

Mamestra anguina *Gr.*

PLATE XXXVIII, FIG. 16.

Fore wings dark ash gray, median space usually somewhat darker. Basal line present. Anterior line outwardly convex, not strongly curved between the veins. Posterior line strongly curved around the reniform, then with a deep inward curve, narrowing the median space by one half. Subterminal line pale, sinuate, strongly marked above the hind angle, where it is crossed by a distinct black streak. Orbicular round, black-ringed. Reniform inwardly black, outwardly gray, its lower part touching the posterior line. Claviform not distinctly outlined, sometimes running across the median space. Hind wings of male whitish, of the female fuscous. Expanse, 29–32 mm.

Rare in this vicinity. May be known by the strongly incurved posterior line, and indefinite reniform. Flies in May and June.

Mamestra vicina *Gr.*

Fore wings light or dark ash gray, with a more or less evident rufous tinge, most marked in the median space. Sometimes the red tinge is absent. A longitudinal black basal streak to the basal line. Anterior line even, outwardly oblique, with an inward curve at the lower part. Posterior line somewhat irregular, nearly parallel with the outer margin. Subterminal line variably distinct, sometimes obsolete, irregular, and always with a whitish spot a little above the angle, sometimes preceded by a row of small black spots. Claviform black-outlined, touching the posterior line. Spots concolorous, outlined with black. Orbicular oblique, more or less oval. Reniform oblique, kidney-shaped. Hind wings varrying from dirty white to grayish fuscous. Expanse 25–32 mm.

Quite rare in this neighborhood. The moth flies in June and July. Easily confused with *M. anguina*, but the posterior line is almost oblique to the outer margin while in *anguina* it is very strongly incurved. It also differs in the complete reniform, black basal streak, and the usually rufous tinge on the fore wings.

Ulolonche modesta (*Morr.*).

PLATE XXXVIII, FIG. 18.

Fore wings with basal, terminal, and half of median space purplish gray; outer half of median space darker purplish-gray. Ordinary spots indistinct, lines conspicuous. Basal line present. Anterior line slightly oblique, undulating, geminate, space between concolorous. Posterior line geminate, included space pale; above it is rounded and projects outwardly beyond the cell; below it extends obliquely to the inner margin. Claviform absent. Orbicular very small, with a fine black ring and a central dot. Reniform indistinct, with a minute white dot at its base. Subterminal space above dark purplish and contrasting with the pale terminal space; below it is lighter and not so well defined. Subterminal line blackish. Terminal space light purplish gray. Hind wings even, dark fuscous, with a faint discal dot. Head and thorax purplish gray. Expanse, 28–30 mm.

Quite rare in this vicinity. The moth flies in June.

Hadena stipata (*Morr.*).

Fore wings rather narrow, pale fuscous, with usually a violet shading along the costa. A black basal streak; one on the inner margin and one in the median space between the two lines. Median vein and its branches white. Transverse basal and anterior lines obsolete. Posterior line faintly visible. Subterminal line faint, slightly marked by dusky shades in the terminal space. A series of minute black dots. Orbicular very small, not visible in some specimens. Reniform indefinite, small, upright, and resting on the white forks of the median view. Hind wings dirty white. Head and thorax concolorous with fore wings. Expanse, 38 mm.

Quite rare in this vicinity. It flies in July and August.

Hadena passer (*Guen.*).

PLATE XXXVII, FIG. 15.

Fore wings varying from dark to pale leathery brown, sometimes with a reddish tinge. Transverse anterior line hardly visible, or absent, outwardly angulate when present. Posterior line distinct but not prominent, curved outwardly and bent inwardly below the middle, crenulate. Subterminal line pale, faint. Orbicular round, black-ringed. Reniform large, more or less completely black-ringed, outwardly pale. Claviform very distinct, heavily outlined in black. Hind wings fuscous. Expanse, 35–45 mm.

Readily known by the conspicuous black-winged claviform and leathery brown fore wings. Occurs in June.

Hadena burgessi (*Morr.*).

Fore wings brown, basal and subterminal spaces usually paler. Basal line present. Anterior line geminate, the outer line of the same more distinct, outwardly oblique, and angulate below the middle. Posterior line dentate on the veins, outwardly bent over the cell, thence parallel with the outer margin. Subterminal line irregular, pale, forming a more or less distinct ≲ and preceded by brown or blackish dashes and followed by blackish intervenular lines to the outer margin. Orbicular rather large, concolorous. Reniform large, kidney-shaped, pale outwardly, black-margined inwardly. Hind wings white, dusky outwardly. Expanse, 35–41 mm.

Rare in this vicinity. Flies in August and September.

Hadena remissa (*Hüb.*).

PLATE XXXVIII, FIG. 10.

Fore wings pale clay brown with the median area dark brown, the line which connects the anterior and posterior lines. A black basal streak and two dark patches on the outer part of the wing. Orbicular and reniform large, pale clay brown. Basal line geminate, rather distinct. Anterior line outwardly bent, the included space pale. Posterior line slightly curved around the cell, thence nearly straight. Subterminal line wavy, pale. A row of black lunules on the outer margin. Hind wings smoky fuscous with a darker median shade line across the middle. Tegulæ shaded with dark brown. Expanse, 35–40 mm.

Not common in this vicinity. Flies in July and August.

Hadena separans *Gr.*

Fore wings dark gray shaded with blackish. Lines black. The subterminal line forms a decided ≶-mark, but not cutting the fringes. A black dash connects the claviform with the posterior line, and the inner margin has a black streak at the base. The terminal space is shaded with blackish above and below its central constriction from the teeth of the subterminal line. Orbicular oblique. Expanse, 36–40 mm.

Recorded from New York, and possibly found in this vicinity. Flies in June.

Hadena suffusca *Morr.*

Fore wings ashen blue gray or pale buff, more or less suffused with reddish brown, always well marked along the costal region. Lines indistinct. Claviform obsolete. Orbicular rounded, small, outlined with rusty. Reniform rather large, black-filled. Terminal space shaded with blackish and a black mark on the lower part of the subterminal line. Hind wings fuscous. Head and thorax concolorous with the fore wings. Expanse, 37–42 mm.

A plainly marked species with the fore wings suffused with red brown. Not common. The moth appears in June, and July.

Hadena vultuosa *Gr.*

Fore wings ocherous, more or less shaded with brown, especially along the costa. A brown black basal streak and another on the inner margin to the anterior line, broader and better marked. Transverse line indistinct or absent in pale specimens. In dark specimens the anterior line is geminate, outwardly arcuate. Posterior line lunulate, imperfect, and followed by a row of geminate, venular black dots. Terminal space with irregular brown patches. Fringes cut with ocherous. A reddish brown median shade, sometimes absent. Orbicular narrow, elongate, sometimes almost elliptical. Reniform upright, constricted at the middle, sometimes very indistinct. Hind wings fuscous. Head and thorax ocherous, marked with rufous, or almost entirely rufous. Expanse, 37–42 mm.

Not common. Found in June and July. A variable species. Sometimes the fore wings are ocherous with the costa and outer margin dark and the marking almost absent.

Hadena apamiformis (*Guen.*).

PLATE XXXVIII, FIG. 5.

Fore wings chocolate brown with the outer margin very dark with two rather prominent projections inward. The markings are more or less distinct, most prominently indicated on the costa. Lines geminate. Anterior line rather prominently scolloped. Posterior line somewhat rounded above, thence parallel with the outer margin, followed by a double row of black dots. Subterminal line wavy, pale. Claviform rather broad, not distinct. Orbicular elongate, concolorous, black-ringed, sometimes with a dark center. Reniform elongate, dark centrally, ocherous outwardly. Hind wings smoky brown. Fringes ocherous. Expanse, 40–50 mm.

Not common. Easily known by the chocolate brown fore wings with darker shadings. The moth flies in May, June, July, and August.

Hadena finitima (*Guen.*).

PLATE XXXVIII, FIG. 11.

Fore wings pale grayish brown, washed slightly with reddish; median space reddish brown. Lines distinct, black. Basal line touching a short black basal streak. Anterior line outwardly arcuate. Posterior line rounded outwardly above, thence bent inward and followed by a row of venular dots. Orbicular large, rounded, pale, touching the anterior line, black-ringed and often with a white anterior annulus. Reniform large, constricted in the middle on both sides, or only outwardly, black-ringed, with a white interior annulus, and sometimes with black powdering below. Claviform small, black-ringed. Subterminal shade-line pale. A terminal row of black dots. Hind wings fuscous, fringes pale. Head and thorax concolorous with the fore wings. Expanse, 35–39 mm.

The moth flies in May and June, and is not uncommon.

Hadena laterita (*Hufn.*).

Fore wings rusty brown, inclining toward reddish, with sparse whitish powdering. Veins blackish. Lines very faintly marked. Orbicular oval, almost absent in some specimens. Reniform large, usually filled with ocherous outwardly. Hind wings fuscous, fringes reddish. Head and thorax concolorous with fore wings. Expanse, 37–50 mm.

Caterpillar.—Head brown with a black triangular mark on the vertex. Body dark gray with large black piliferous spots. Spiracles brown. Cervical shield and anal plates black, the former with a brown line in the middle. Length, 40 mm.

Food-plants.—Grass and other low plants.

A very widely distributed species, found in the United States and Canada, from the Atlantic to the Pacific, and also in Europe. The moth flies in June, July, and August.

Hadena dubitans (*Walk.*).

Fore wings glossy purplish brown black, with the lines obsolete. Subterminal line pale, broken, preceded by glossy marks. Orbicular usually obsolete, oval, sometimes powdered with white. Reniform large, contrasting, partly filled with yellowish white. Hind wings fuscous, fringes pinkish. Head and thorax concolorous with the fore wings. Expanse, 40–44 mm.

A common species, found during July, August, and September. May be recognized by the dark fore wings with contrasting reniform.

Hadena ducta *Gr.*

Fore wings blackish. Transverse lines double. Subterminal line whitish, narrow, continuous, and followed by deep black intervenula dashes; the usual ≤-mark indicated, not very prominent. Fringes blackish with pale dots on the veins. Reniform large, black-ringed, filled with white. Claviform concolorous, moderate, a black shade along the submedian fold, connecting the two lines where they are approximate. Median shade black, inconspicuous. Posterior line lunulate. Hind wings fuscous. Head and thorax blackish. Expanse, 40 mm.

Recorded from New York and possibly found in this vicinity.

Hadena impulsa (*Guen.*).

PLATE XXXVIII, FIG. 19.

Fore wings black with the markings intense velvety black. Transverse lines geminate. Basal line joining a short basal streak. Anterior line arcuate, rounded between the veins. Posterior line scolloped, the outer part less distinct. Subterminal line composed of yellowish dots, preceded by black dashes. An oblique median shade, in its lower course parallel with the posterior line. Claviform distinct. Orbicular rounded. Reniform rather large, the inner part resting on the median shade line, the outer part with a few pale scales. Hind wings smoky, paler at the base. Head and thorax blackish. Expanse, 32–42 mm.

Not common. Flies during May, June, and July. The species may be known at a glance by the black fore wings with intense velvety black markings.

Hadena devastatrix (*Brace*).

Fore wings varying from pale ocherous gray to dark blackish gray sprinkled with light gray. The markings are, as a rule, distinct. Transverse line darker than the ground color, with the included spaces paler. Basal line present. Anterior line outwardly oblique, often curved between the veins. Posterior line rounded over the cell, thence inwardly oblique. Subterminal line whitish, preceded by black sagittate dashes. A terminal row of black, lunulate dots.

Claviform rather large, usually distinct, outlined with black. Orbicular variable in size, black-ringed, sometimes marked with yellowish. Reniform large, upright, constricted, black-ringed, with an inner yellowish annulus. Hind wings fuscous, paler basally. Head and thorax concolorous with the fore wings. Expanse, 35–45 mm.

Caterpillar.—Head very glossy chestnut brown ; mouth parts pitchy black. Cervical rounded at the sides and behind, testaceous ; anterior edge blackish, glossy. Body dirty brownish white, very glossy, with a dark band at the junctions of the segments. A few hairs are scattered over the body, arising from small black piliferous spots. Thoracic feet testaceous, tips pitchy black. Spiracles black. Abdominal legs not prominently developed. Length, 30 mm.

Food-plants.—All kinds of herbaceous plants.

One of the most common species, found everywhere from the Atlantic to the Pacific. Flies from June until late in the fall. The larva lives in a burrow, several inches deep, coming forth at night to feed.

Hadena arctica *Bdv.*

Fore wings carmine brown, basal and subterminal spaces more or less bluish gray ; terminal space darkest. Anterior line slightly oblique, rounded between the veins. Posterior crenulate, spaces between lines grayish. Subterminal irregular, ocherous, preceded by a rusty brown shade. Claviform carmine brown, a little darker than the ground color of the wings, not contrasting. Orbicular round, concolorous, more or less powdered with pale. Reniform large, upright, with an ocherous mark outwardly, and speckled with white. Hind wings fuscous, with a dark discal shade mark. Head and thorax concolorous with the fore wings. Expanse, 40–50 mm.

Caterpillar.—Head tawny yellow. Body pale smoky gray. Cervical shield tawny yellow. Anal plates brown. Piliferous spots each with a short hair. Length, 36 mm.

Food-plants.—Various kinds of herbaceous plants.

An exceedingly common species, found everywhere east of the Rocky Mountains. In this vicinity the moth appears in June and flies until late in September. It may be known at once by the carmine brown color of the fore wings, with bluish gray subterminal space.

Hadena verbascoides (*Guen.*).

Fore wings rather pale ocherous brown with a rich longitudinal shade through the middle ; costal region pale, veins marked with black. Basal line absent. Anterior and posterior lines obsolete ; the latter is composed of a series of small, geminate, venular dots as far as the submedian space, where it forms a distinct pale lunule, margined by narrow black lines. Subterminal line broken, not distinct, crossed in the middle by two dashes to the outer edge of the fringes, which are cut with ocherous above. Orbicular and reniform scarcely visible. A short black basal streak, a large one below and beyond, touching the pale lunule, and another short one at the base a little above the inner margin. Terminal space dark, except at apex. Median vein marked with white on its furcation. Hind wings fuscous, usually paler at base. Head pale ; thorax pale along the middle ; collar and tegulæ dark brown. Expanse, 38–42 mm.

Not common in this vicinity. The moth flies in June, July and August. May be known by the ocherous fore wings, with dark brown longitudinal shades and streaks.

Hadena nigrior (*Smith.*).

Fore wings purplish brown with the markings like those of *H. verbascoides*, but more distinct. Costal region marked with gray to the posterior line. Basal line geminate, indicated on the costa. Posterior line indicated by whitish scales and geminate venular dots defining its course. Subterminal line pale, broken, sending two prominent teeth to the outer margin at the middle. Orbicular elongate, pale-ringed, small. Reniform larger, upright, pale-ringed. Longitudinal black dashes similar to those of *H. verbascoides*. The one at the inner margin at base is followed by a white shade and outwardly defined by a black line. Hind wings smoky, paler basally, fringes ocherous. Head pale, thorax dark, pale centrally behind. Expanse, 37–45 mm.

Allied to *H. verbascoides*, but very much darker, with distinct ordinary spots on the fore wings. Quite rare in this neighborhood. Flies in June and July.

Hadena cariosa (*Guen.*).

PLATE XXXVIII, FIG. 21.

Fore wings pale gray brown, dark brown below the costa to the posterior line, and on the terminal space. Lines double. Basal line marked on the costa only. Anterior line wavy, outwardly oblique, bent inward a little above the inner margin where it is defined by a whitish streak, above which there is a black dash. Posterior line not prominent, outer part defined by a double row of small black dots. Subterminal line pale forming a distinct ⩽-mark at the middle ; preceded by black brown dashes in the pale subterminal space. A deep black basal dash ; below and a little beyond it is a similar dash touching the posterior line, on both sides thence to the subterminal line. Orbicular pale, good sized, round. Reniform oblong, large, upright. Hind wings dark fuscous, fringes ocherous. Head pale, thorax pale, with dark tegulæ and collar. Expanse, 35–42 mm.

Rather rare in this vicinity. The moth flies in June and July.

Hadena vulgaris (*G. & R.*).

Fore wings ocherous brown, marked with a little darker brown, especially between the veins and on the terminal space. Veins marked with black. Transverse lines and ordinary spots indistinct. Anterior line outwardly oblique, rather strongly dentate, indefinite through the wing. Posterior line vague, followed by a double row of small black dots. Subterminal line not distinct, with a ≶-mark at the middle. Basal dash and the one below on the inner margin not distinct; the dash from the claviform to the subterminal line broken by the posterior line. Orbicular elongate. Reniform upright, both vaguely defined. Head and thorax pale, the latter with a dark line on the tegulæ. Hind wings ocherous fuscous. Expanse, 40–45 mm.

Not common. Found during May, June, and July.

Hadena lignicolor (*Guen.*).

PLATE XXXVIII, FIG. 15.

Fore wings pale luteous, thickly scaled and shaded with reddish brown, especially along the costal region; terminal space darker, except pale at the apex. Lines more or less distinct but never prominent. Anterior line dentate. Posterior line rather even, outer line partly punctate. Subterminal line with ≶-shaped mark distinct. Ordinary spots concolorous, not well defined. Orbicular elongate, variable in shape. Reniform upright, lower part filled with dark. Basal dash at middle and inner margin not very distinct. Hind wings fusco-luteous, fringes pale. Head and thorax reddish ocherous. Expanse, 40–47 mm.

A common species, found during June, July, and August.

Hadena inordinata *Morr.*

Fore wings luteous brown, especially in the basal and median areas, terminal space brownish, costa scaled with white. Lines black filled with white, prominent. Anterior line almost straight, lower half bent outwardly and again inwardly before it reaches the inner margin. Posterior line bent around the cell, thence inwardly oblique, and rather even. Subterminal line white, preceded by black, sagittate marks; ≶-mark prominent. A terminal row of black dots. Fringes dark, cut with pale. Orbicular oblique, white-ringed. Reniform rather large, white-ringed, with a dark center. Hind wings ocherous, a broad dark outer border, a narrow median line and large discal mark, dark ; fringes pale. Head and thorax ocherous gray. Expanse, 32–35 mm.

Not as yet recorded from this vicinity, but possibly will be found here when we know more about the noctuid fauna. Flies in May and June.

Hadena bridghami (*G. & R.*).

Fore wings rather bright purplish red, tinged with yellowish, especially in the median space ; basal space scaled with bluish white. Subterminal space rather bright bluish or purplish white to the apex. Terminal space like the median space. Ordinary spots bluish white and rather conspicuous. Basal line evident, pale. Anterior and posterior lines obsoletely geminate, included spaces bluish white. A reddish angular median shade line, not contrasting. Hind wings whitish, with an indistinct median line, dusky or reddish outwardly ; fringes white. Head and thorax whitish, marked with reddish. Expanse, 28–32 mm.

A beautiful, well-marked species, not easily confounded with any other found in this vicinity. Flies in June and July.

Hadena claudens *Walk.*

Fore wings white, gray, and black, very distinctly marked. Lines black, geminate. A black basal dash. Anterior line black, its inner course indistinct, erect, touching the orbicular, dentate on costa ; opposite orbicular, a broad obtuse tooth from median to submedian vein and a shorter one at inner margin. Posterior line well exserted around the reniform, and running strongly inward below, scolloped, outer line faint. Orbicular white, irregularly rounded, a little oblique. Reniform good sized, white, kidney-shaped. Claviform concolorous, defined by two narrow black lines running across the median space. Veins on submedian space marked with black. Subterminal line with the usual ≤-mark much reduced. Terminal line black, interrupted. Hind wings dark fuscous, fringes whitish. Head and thorax whitish ; tegulæ lined with black. Expanse, 30 mm.

Recorded from New York, and very likely found in this vicinity. The moth appears in July and August.

Hadena fractilinea *Gr.*

PLATE XXXVII, FIG. 17.

Fore wings dull brownish and pale flesh-color, the pale color extending along the inner margin and subterminal space to the apex. Terminal space brownish, narrowly flesh-color beyond the ferruginous subterminal line. The transverse lines not prominent, the posterior line followed by a double row of small black dots. Orbicular obscured by the dark brown. Reniform small, flesh-colored, with a dark central dot. Hind wings fuscous. Thorax dark brownish, flesh-color along the middle, posteriorly. Expanse, 26–30 mm.

Var. VULVIVAGA.—Like the type form, but the entire fore wings are almost uniform dark fleshy brown, there being no contrasting colors.

Not common. Found in July and August.

Hadena misera *Gr.*

Fore wings dark fuscous with inconspicuous markings. Reniform moderate, discolorous, yellowish. Orbicular hardly indicated. Lines lost, except the waved, rusty yellow subterminal line. Costa dotted with pale yellowish. Hind wings dark fuscous, paler than fore wings, with a discal dot and median line. Head, collar, and tegulæ blackish fuscous. Disk of thorax somewhat rusty and paler.

Recorded from New York, and possibly found in this vicinity. August.

Hadena miseloides *Guen.*

PLATE XXXVIII, FIG. 12.

Fore wings mossy green with darker shadings, especially along the veins. Lines black, geminate. Basal line present. Anterior line strongly waved. Posterior line dentate, very slightly bent around the reniform. Subterminal line pale green, not very distinct. Orbicular variable in size, concolorous. Reniform very large, concolorous or pure white. Claviform filled with black. Hind wings fuscous. Head and thorax mossy green. Expanse, 30–35 mm.

The mossy green color of the fore wings, with the very large reniform spot, which is often white, will serve to distinguish this species at a glance. It is rather common and flies in June, July and August. The larva is green and lives solitary on smilax.

Hadena mactata (*Guen.*).

Fore wings rather rich brown with the subterminal and basal space usually paler. Basal line evident. Anterior line outwardly very oblique, slightly wavy, and forming a tooth at the inner margin. Posterior line curved around the reniform, thence evenly bent inward, slightly crenulate. Spaces between lines usually pale. Subterminal line pale. Claviform outlined with black, connected with the posterior line by a black dash. A short black basal dash also present.

Orbicular variable in size, usually large, round; reniform larger. These spots are light or dark. Hind wings fuscous. Head and thorax brown, mixed with light brown. Expanse, 30–35 mm.

A rich brown species with orbicular and reniform large. It is not common, and flies in July, August, and September.

Hadena turbulenta (*Hüb.*).

PLATE XXXVIII, FIG. 20.

Fore wings varying from light to dark wood brown, the outer part usually palest. Lines geminate. Basal line present. Anterior line oblique, wavy, and forming a tooth at the inner margin. Posterior line rather prominently dentate around the reniform, thence crenulate. Orbicular small, concolorous. Reniform oblique, large, light or dark. Claviform black-ringed, small. Beyond the posterior line to a little above the hind angle is a broad black dash and two or three streaks at the costa in front of the apex. Subterminal line scarcely evident. Hind wings dusky outwardly, paler at base, an indistinct discal spot and mesial line. Head and thorax brown. Expanse, 22–32 mm.

Caterpillar.—Head jet black; mouth parts sordid white. Body above jet black with a number of fine longitudinal white lines, beginning at the anterior part of the second segment and ending at the end of the tenth segment. Last segments with a number of white spots. Cervical shield velvety black. Body at sides and beneath dull amber yellow. At the sides are three white stripes, two of them below the spiracles. Thoracic feet black. Abdominal and anal legs dull amber yellow with a brownish patch, followed by a white one, on the outside. All the lines on the black part of the body are connected posteriorly.

Food-plant.—Catbriar (*Smilax*).

The larvæ of this species are more common than the perfect insects. They live socially in all their stages, in rather dense clusters. The moth may be found in May, June, and August.

Hadena modica (*Guen.*).

PLATE XXXVIII, FIG. 6.

Fore wings pale whitish gray with the median space very dark, basal space tinged with ocher gray. Sometimes both median and basal spaces are dark. Anterior line curved outwardly, touching the orbicular, which is pale or dark, not distinct and contrasting. Posterior line very indistinct, scarcely traceable, followed by a row of black dots. Subterminal line vague. Fringes dark, cut with pale. On the costa are two black marks, sometimes connected and forming a semicircular line. Reniform large, pale, dark-ringed; on the outer part a ligth ocherous rounded shade, looking like a part of the reniform. Claviform dark, black-outlined. A blackish median shade. Hind wings fuscous. Expanse, 25–32 mm.

Common, but not abundant. Flies in June, July, and August.

Hadena hausta *Gr.*

Fore wings deep brown to the transverse posterior line, except over the reniform. Subterminal space grayish. Terminal space narrow, ferruginous. A costo-apical light brown spot on the subterminal space. Fringes dark, finely cut with pale. A black mark in place of the claviform, across the median space. Anterior and posterior lines double, indistinct. Reniform grayish. Hind wings pale fuscous, with a darker median line. Head and thorax dusky brownish. Expanse, 21 mm.

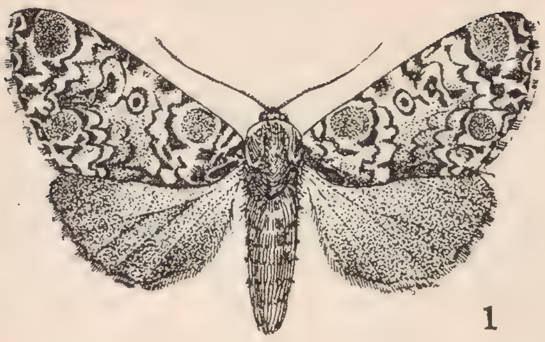
Quite rare in this neighborhood. Flies in April and May.

Hadena diversicolor (*Morr.*).

Fore wings with the basal space green, median space brown black to the median black shade line, beyond which the wing is white, shaded with light green in the subterminal and terminal spaces. Anterior line distinct, double, touching the orbicular, notched on the costa, and forming an outward lobe to the inner margin. Posterior line not distinct, dentate opposite the cell. Subterminal line white, irregular, with two blunt teeth and a black dash above the hind angle. Orbicular elliptical, whitish, contrasting, with a green inner shade; it opens into a basal, costal, greenish white shade. Reniform hardly visible. Claviform concolorous. A series of terminal black dots. Fringes dark, cut with ocherous. Hind wings whitish, with a dark discal dot, angulated median shade line and terminal shade. Head and thorax light gray, tuft of latter tipped with black. Expanse, 32 mm.

Recorded from New York and may be found here. Flies in September.

(*To be continued.*)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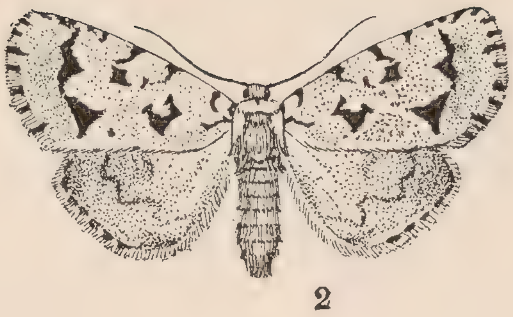
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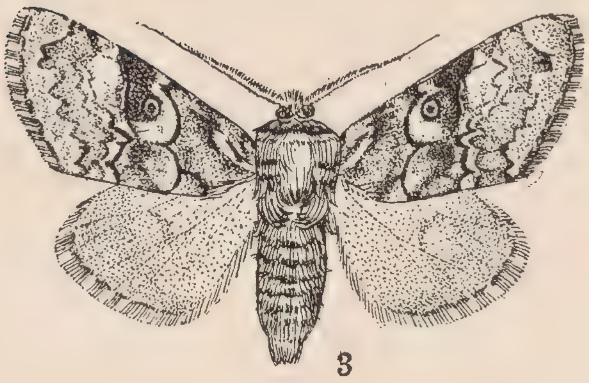
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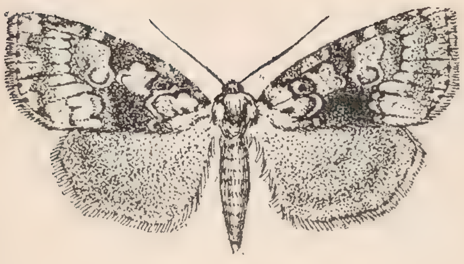
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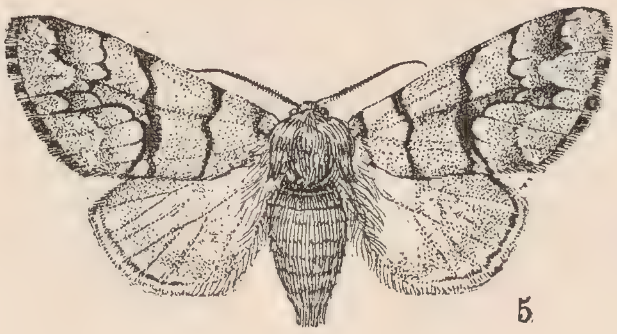
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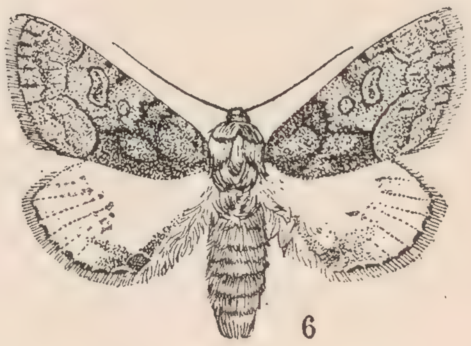
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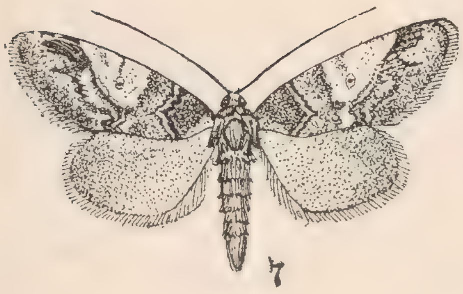
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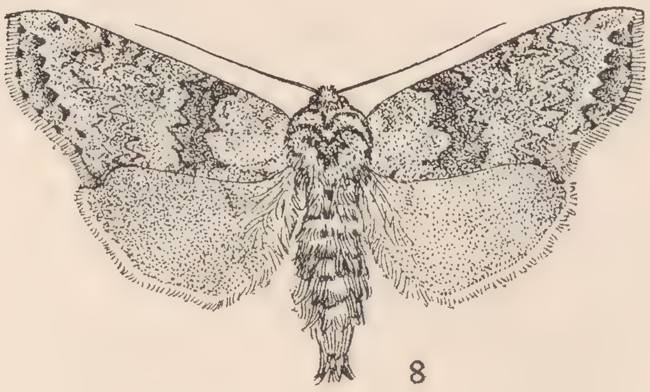
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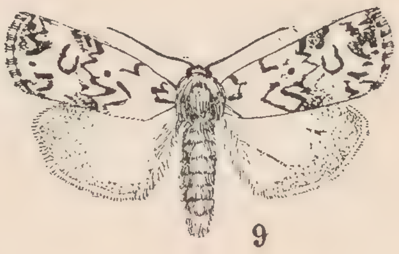
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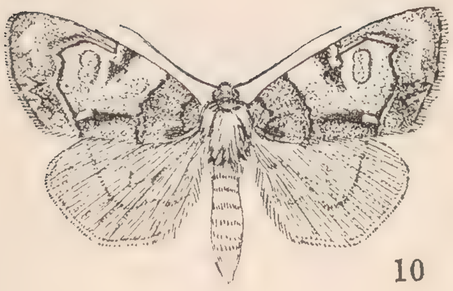
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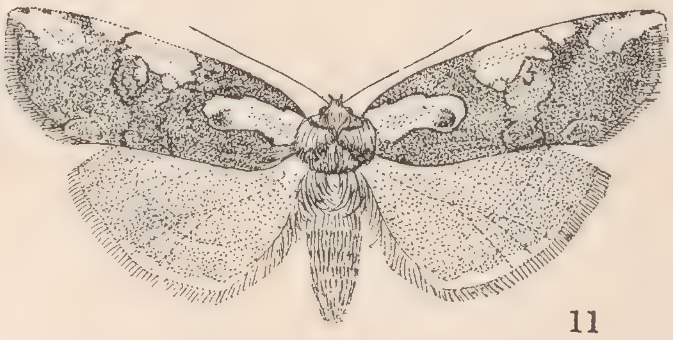
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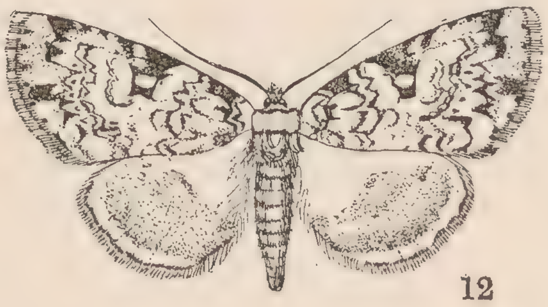
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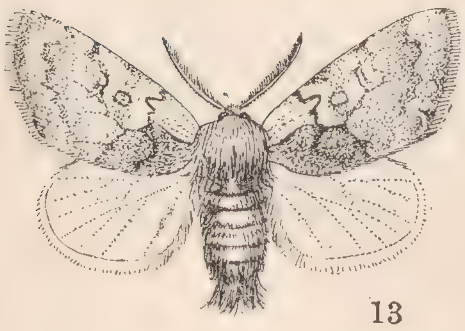
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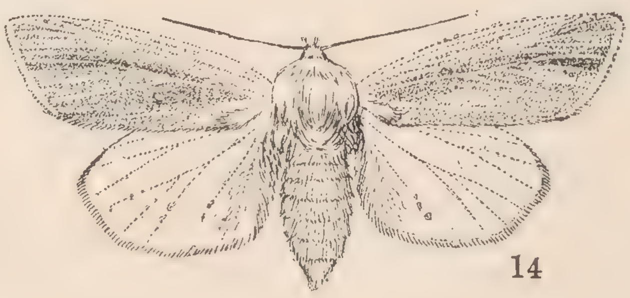
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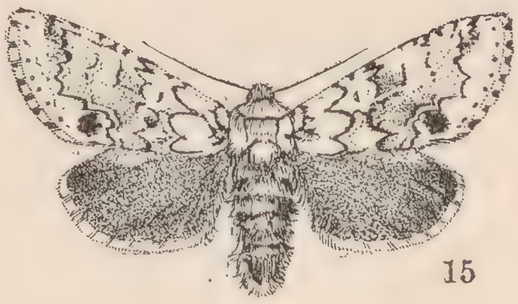
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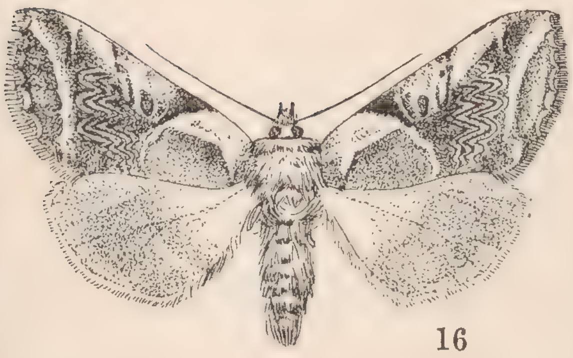
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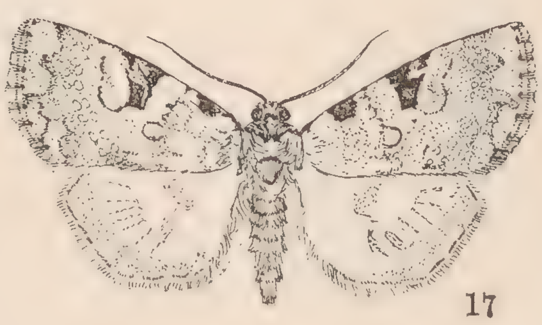
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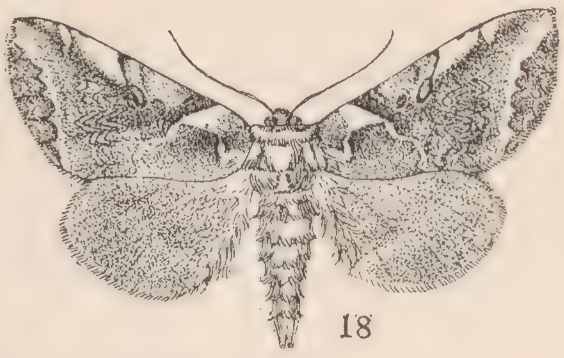
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7. Leptina dormitans.
8. Pseudothyatira expultrix.
9. Polygrammate hebraicum.
10. Chytonix palliatricula.
11. Euthyatira pudens.
12. Microcœlia diphteroides.
13. Demas flavicornis.
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17. Microcœlia diphteroides var. obliterata.
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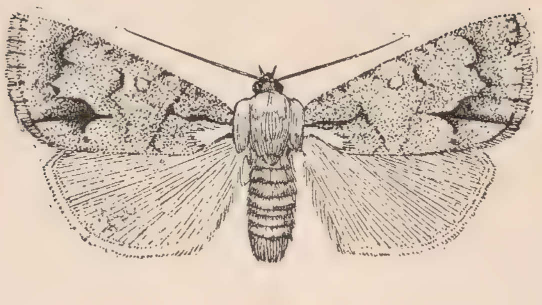
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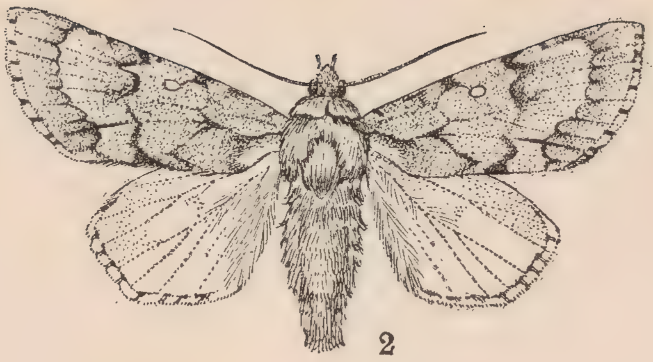
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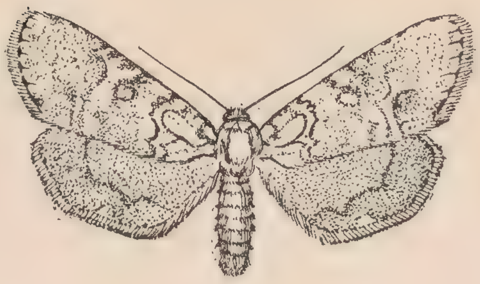
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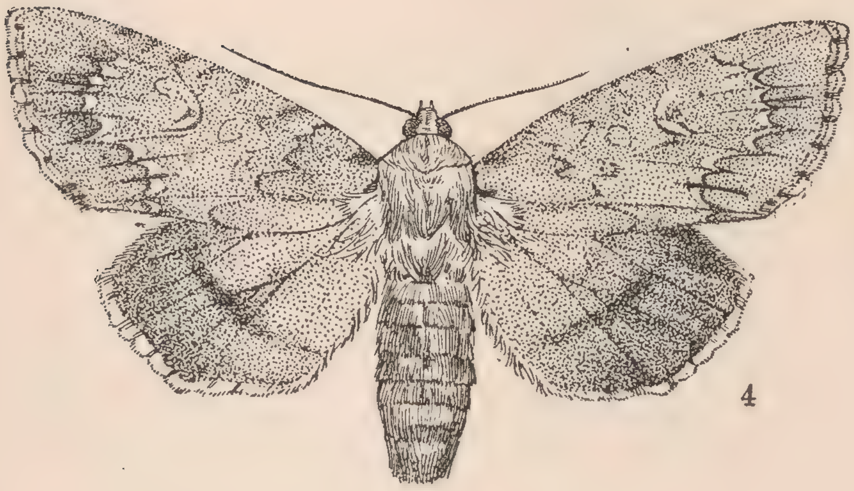
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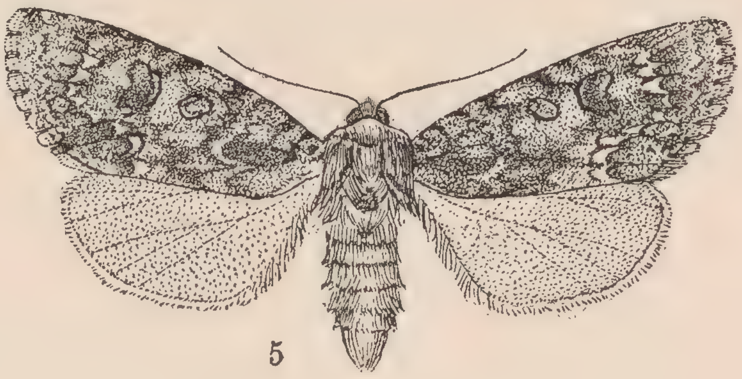
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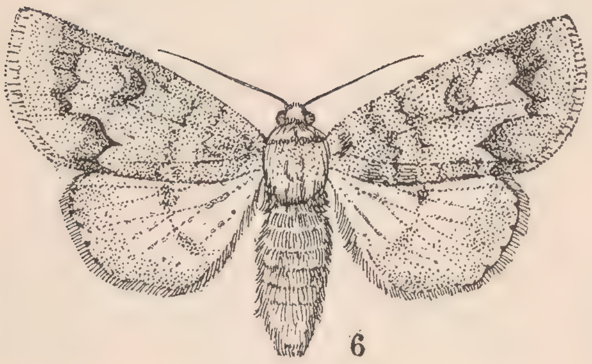
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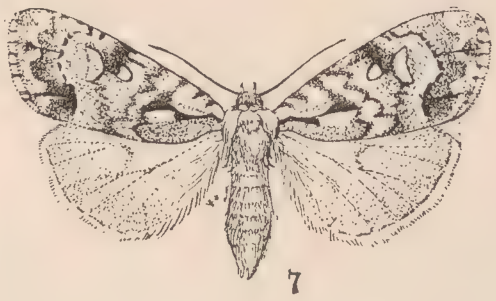
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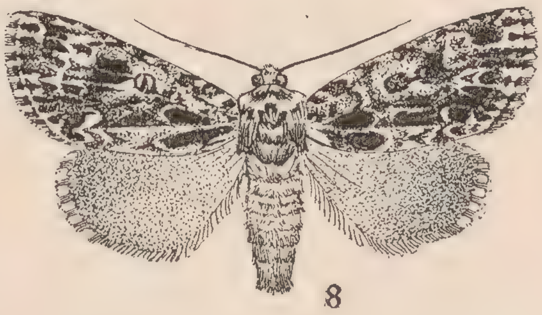
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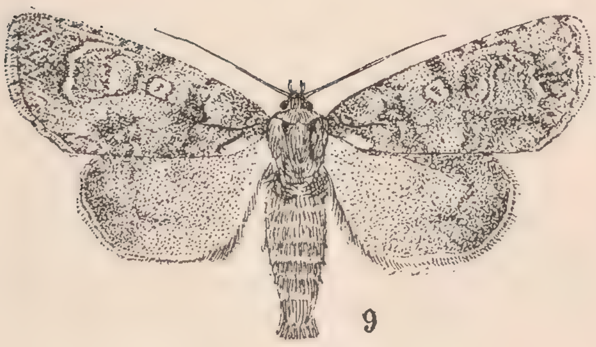
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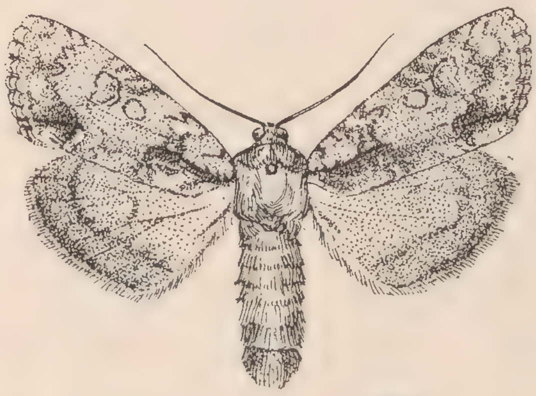
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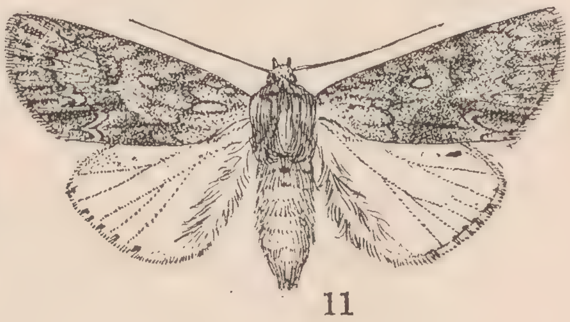
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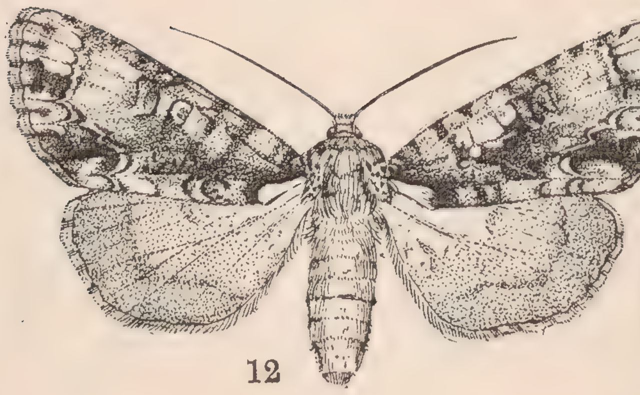
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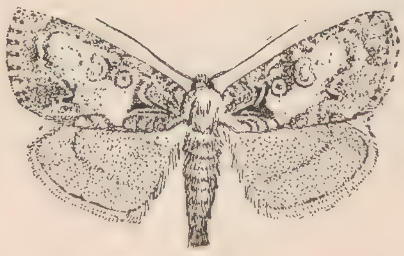
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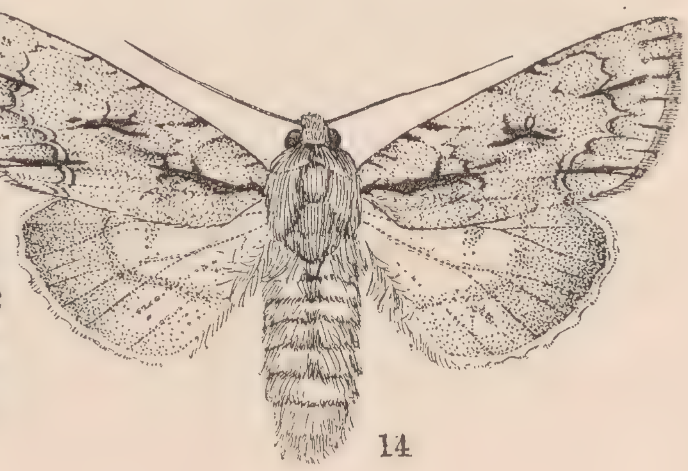
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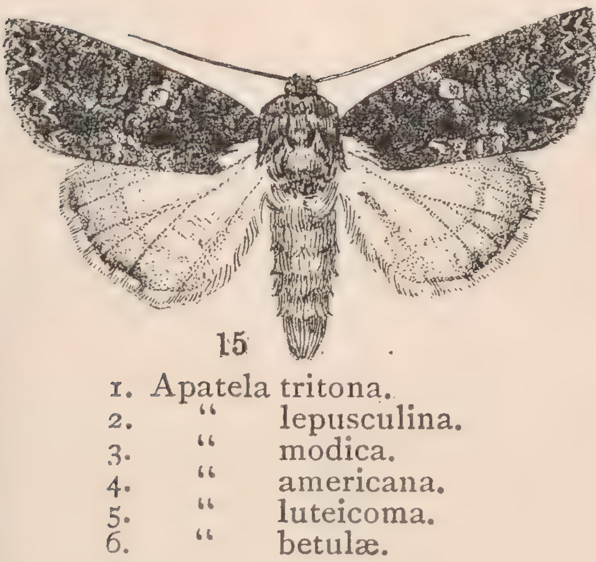
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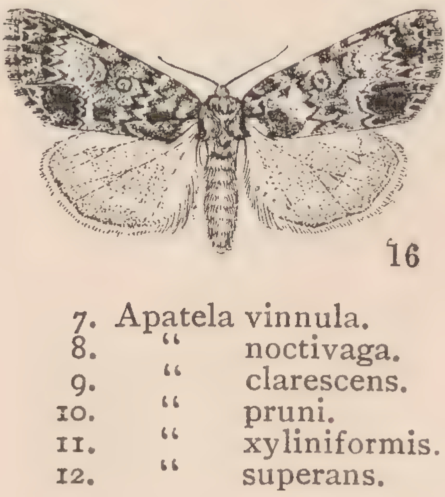
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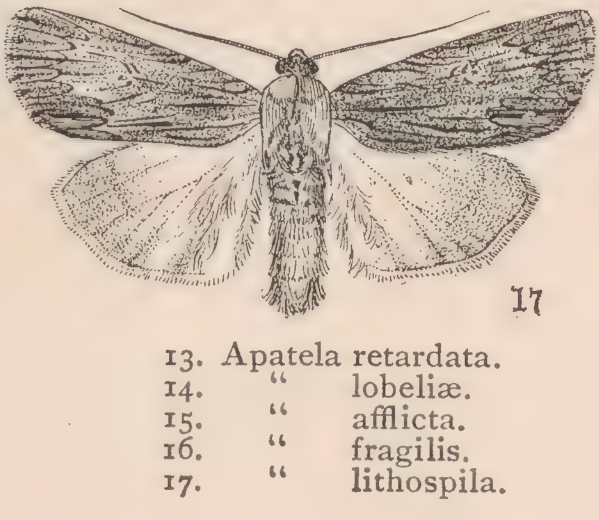
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5. " luteicoma.
6. " betulæ.

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8. " noctivaga.
9. " clarescens.
10. " pruni.
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12. " superans.

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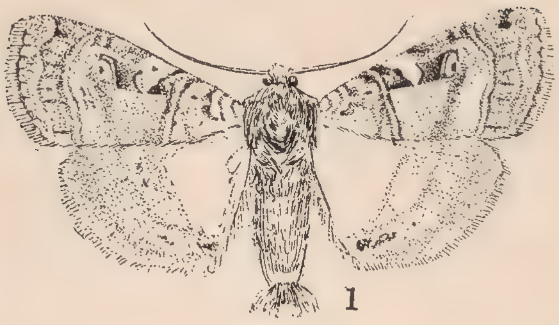
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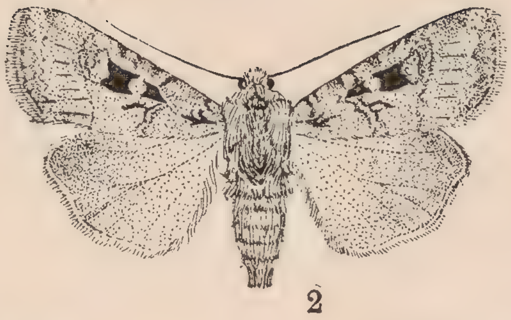
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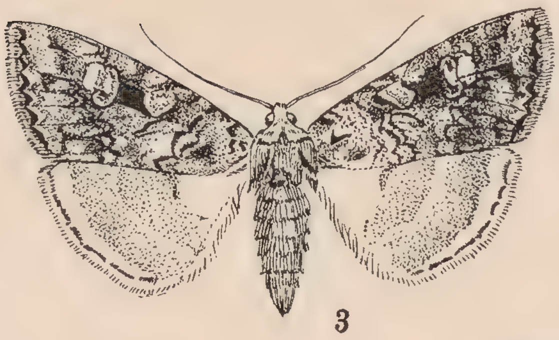
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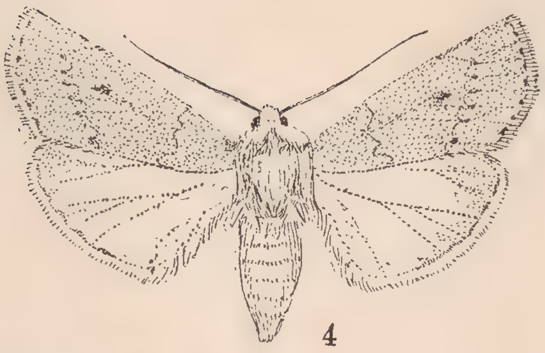
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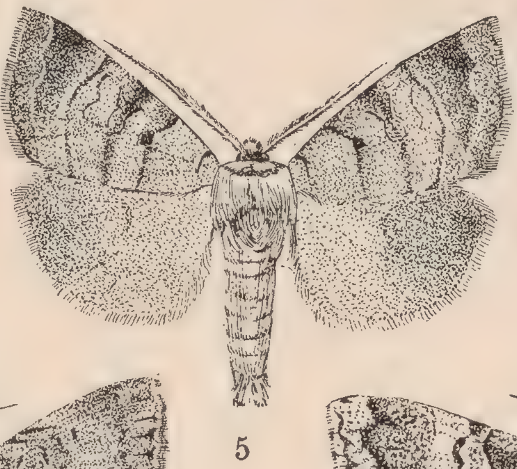
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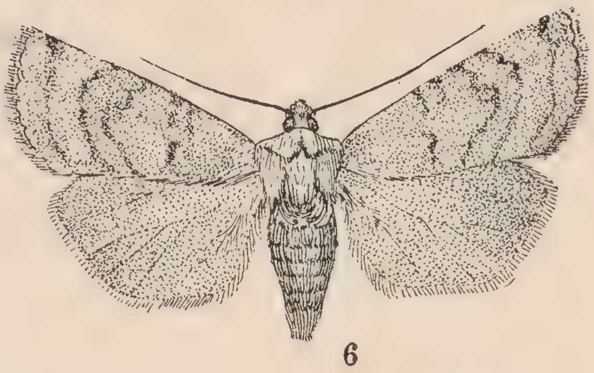
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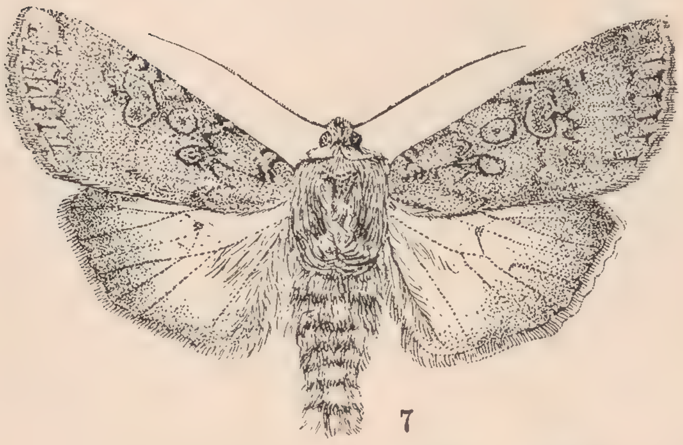
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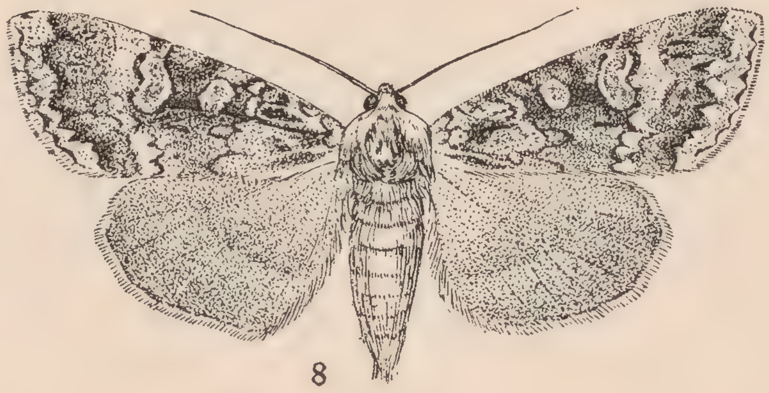
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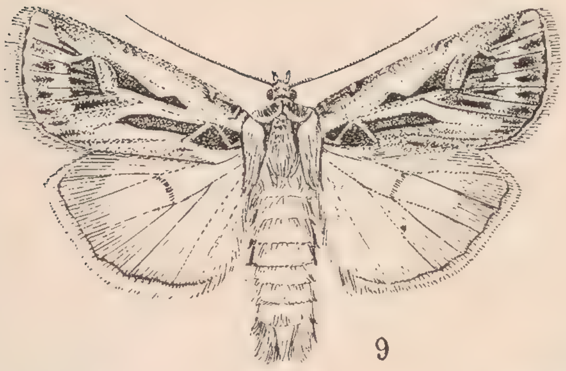
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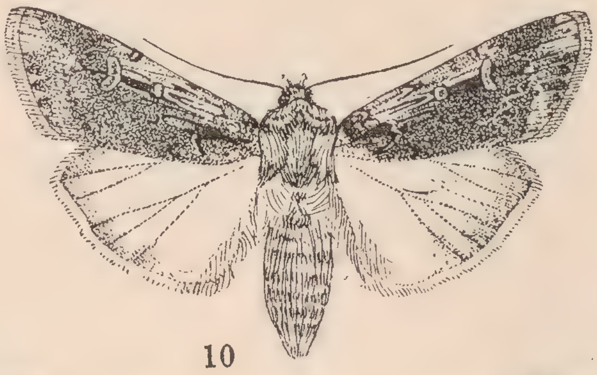
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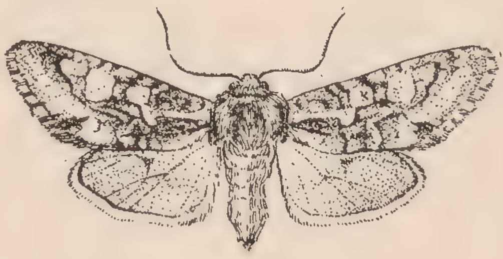
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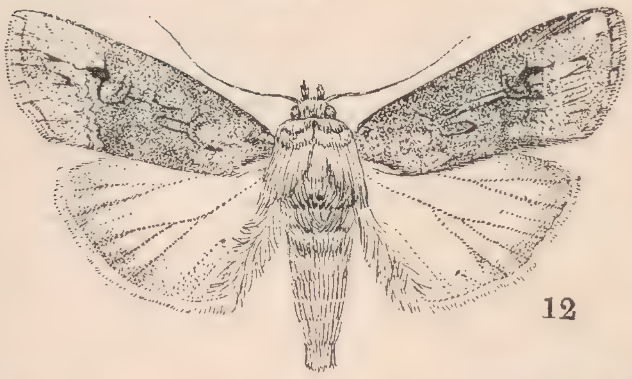
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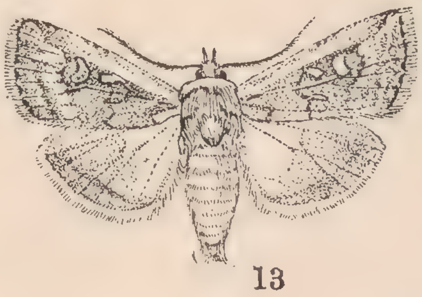
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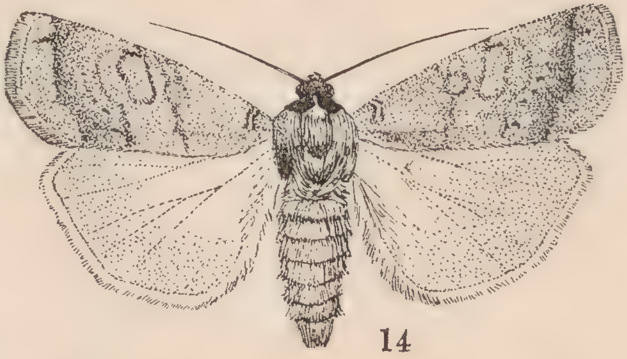
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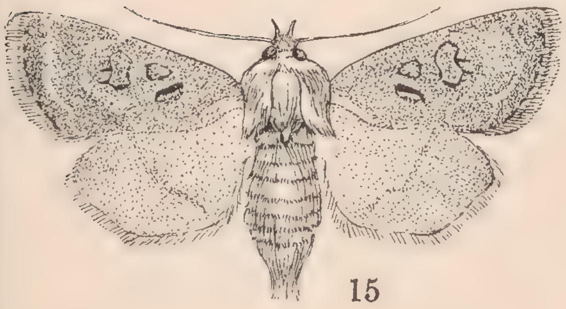
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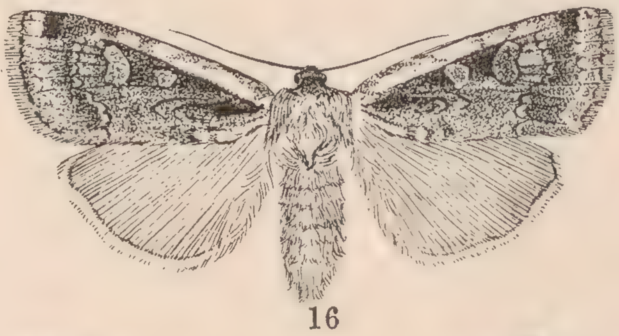
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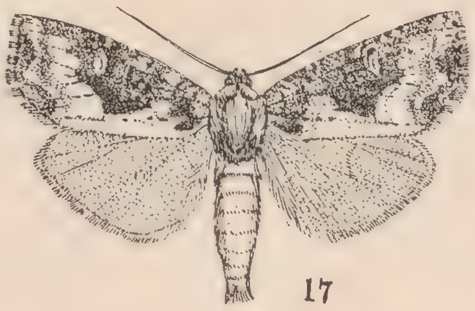
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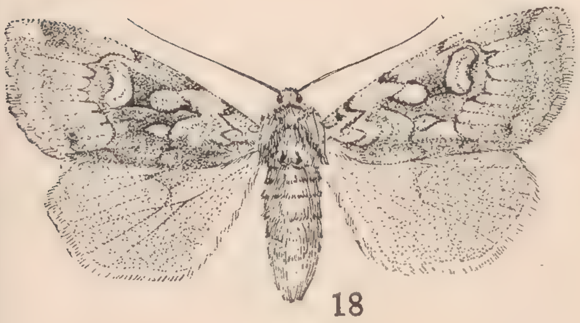
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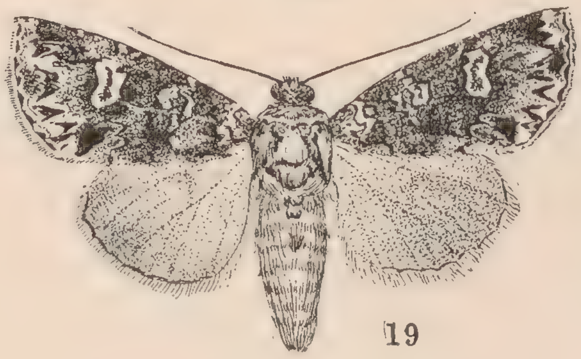
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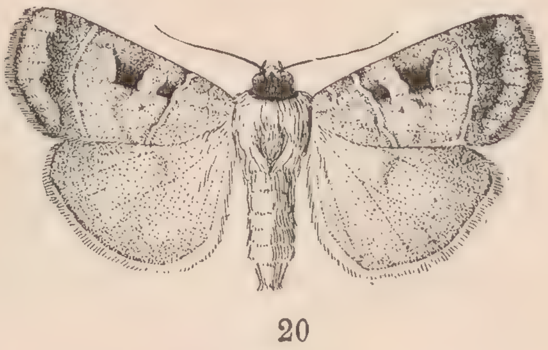
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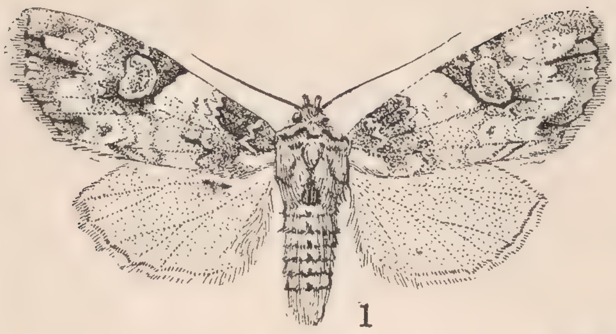
1. Noctua normaniana.
2. Carneades tessellata.
3. Platagrotis pressa.
4. Porosagrotis vetusta.
5. Agrotis badinodis.
6. Carneades bostoniensis.
7. Peridroma saucia.
8. Adelphagrotis prasina.
9. Feltia subgothica.
10. “ annexa.
11. Psaphidia grotei.
12. Agrotis ypsilon.
13. Carneades detersa.
14. Rhynchagrotis rufipectus.
15. Hadena passer.
16. Eueretagrotis sigmoides.
17. Hadena fractilinea.
18. Semiophora elimata.
19. Mamestra adjuncta.
20. Noctua collaris.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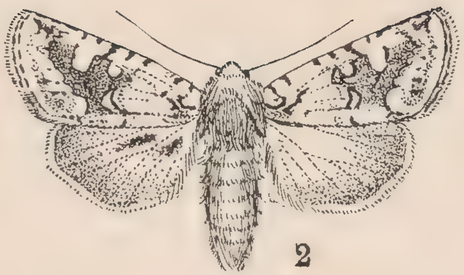
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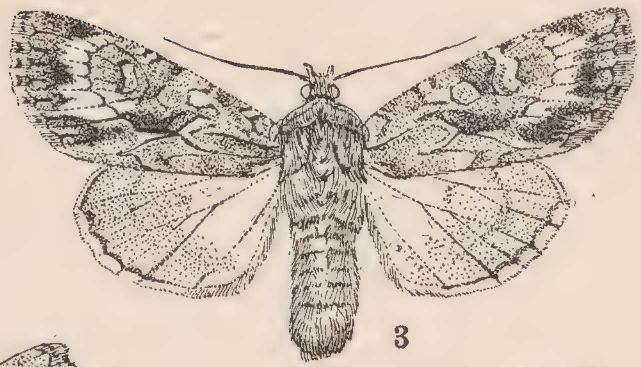
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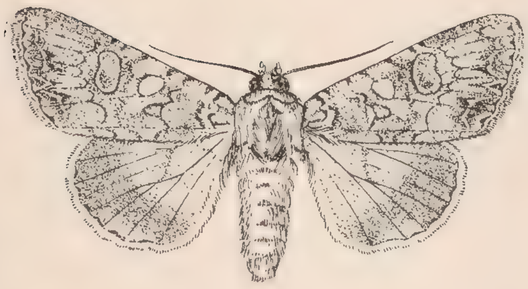
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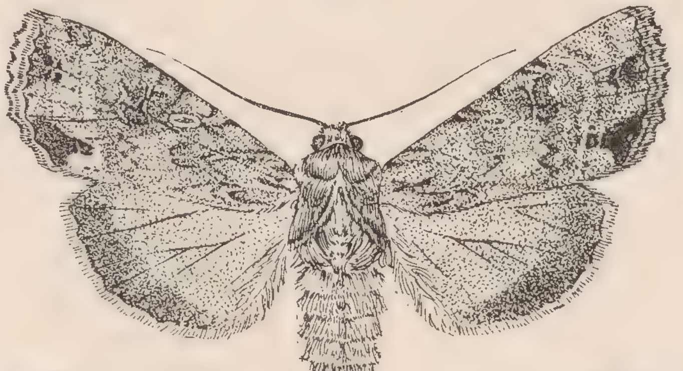
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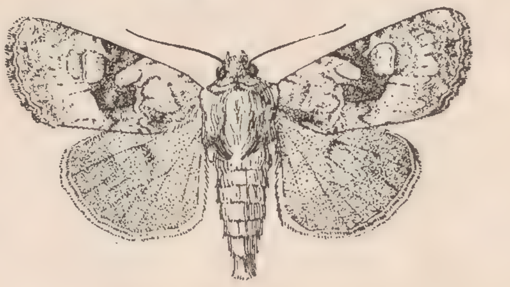
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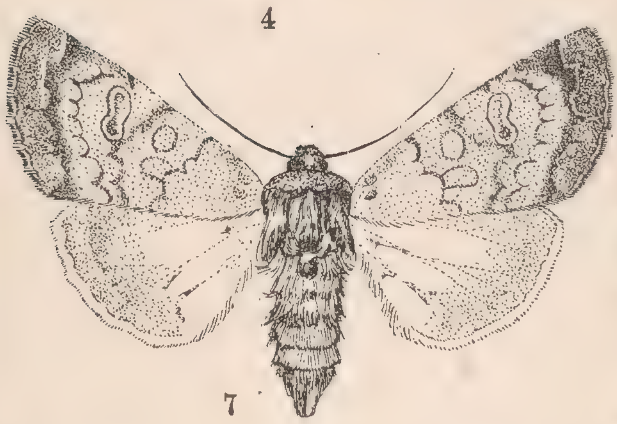
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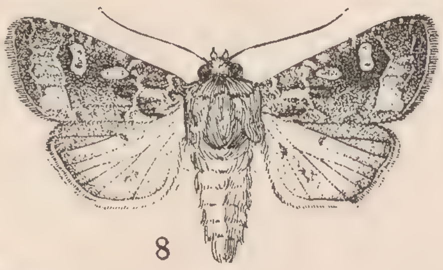
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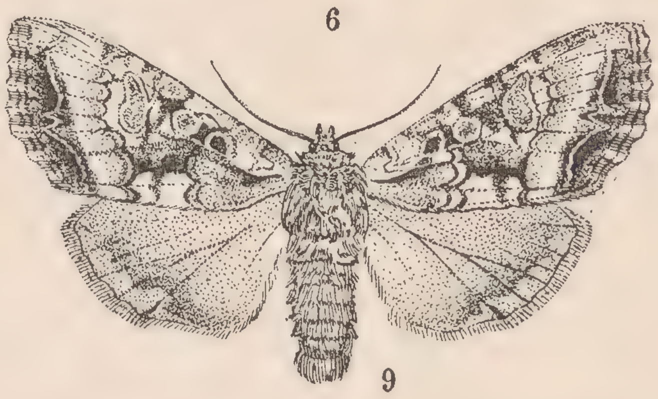
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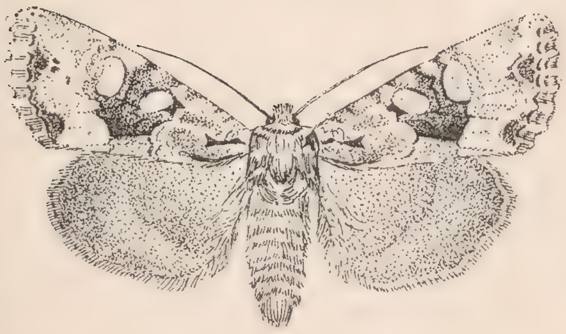
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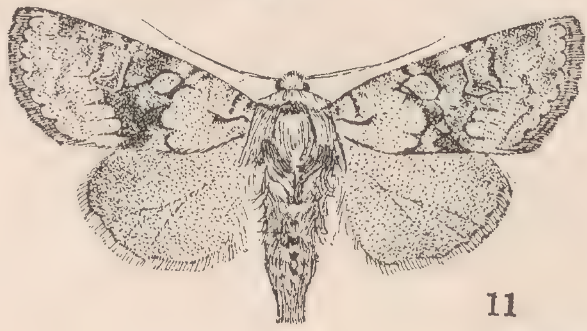
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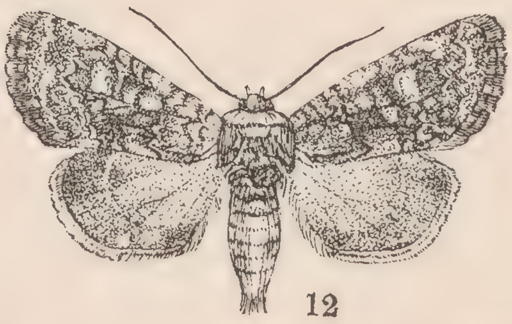
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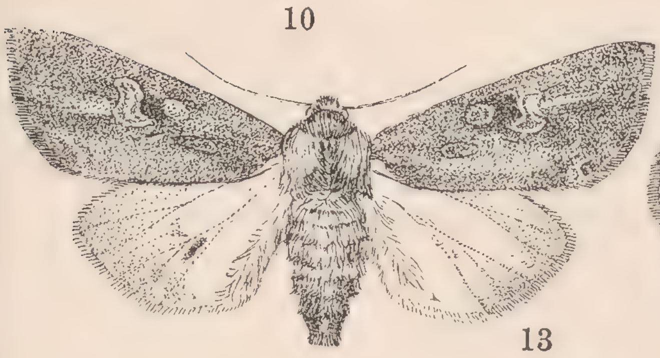
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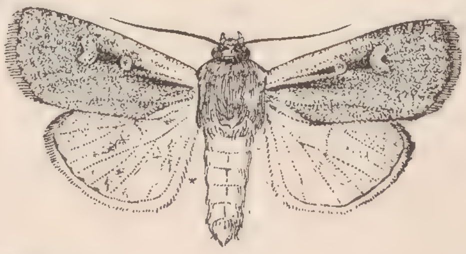
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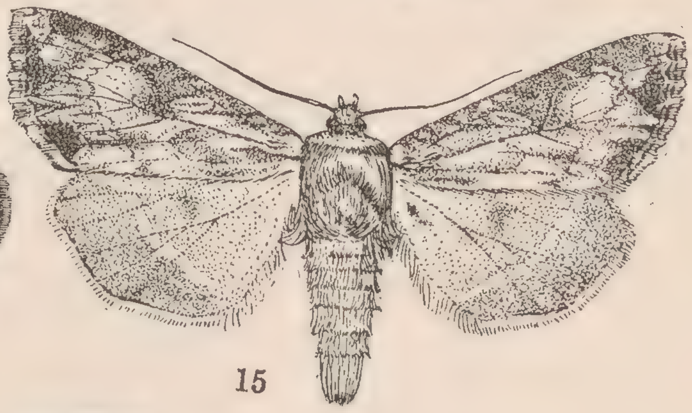
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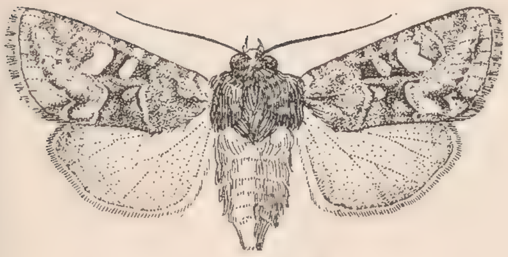
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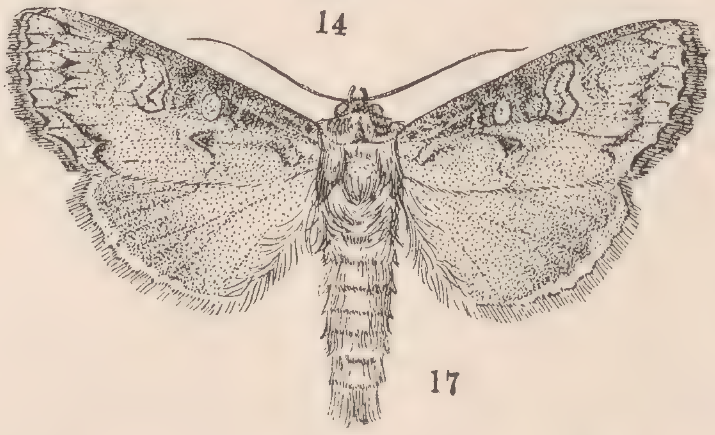
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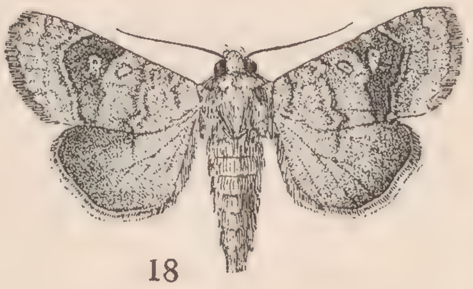
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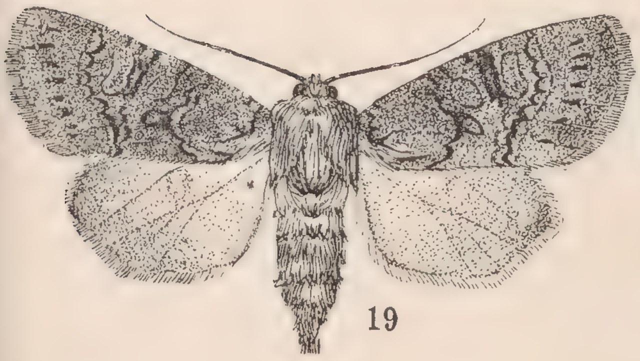
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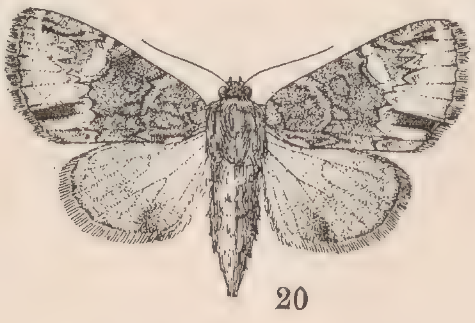
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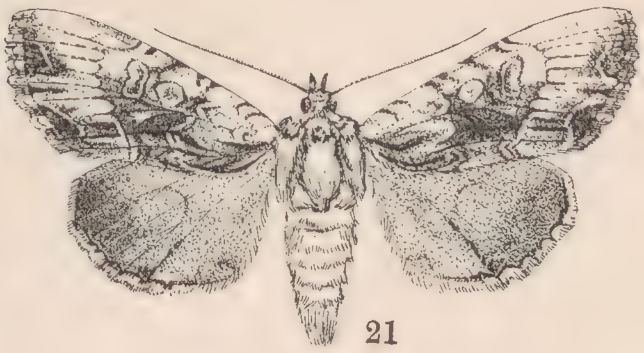
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1. Mamestra latex.
2. " laudabilis.
3. Anytus privatus.
4. Mamestra trifolii.
5. Hadena apamiformis.
6. " modica.
7. Mamestra rosea.
8. Mamestra renigera.
9. " grandis.
10. Hadena remissa.
11. " finitima.
12. " miseloides.
13. Mamestra picta.
14. Noctua plecta.
15. Hadena lignicolor.
16. Mamestra anguina.
17. " purpurissata.
18. Uloloncha modesta.
19. Hadena impulsa.
20. " turbulenta.
21. " cariosa.

Article XXI.—A REVISION OF THE GENUS CAPROMYS.

By FRANK M. CHAPMAN.

PLATES XXXIX–XL.

Mr. G. S. Miller, Assistant Curator of Mammals in the U. S. National Museum, having very kindly loaned me all the specimens of *Capromys* contained in the collections under his charge, their addition to the specimens of this genus in the American Museum of Natural History doubtless brings together a larger number of examples of this West Indian group of mammals than has heretofore come to the attention of mammalogists at one time. Indeed, it is quite possible that the combined collections of all other museums would not result in the formation of so large a series.

Opportunity is thus offered for a study of the variations presented by some of the species of *Capromys*, including a series of *C. prehensilis* from the Isle of Pines, while the changes in the character of the dentition with age can now be shown, giving a better basis for the determination of the relationships of the island-inhabiting members of the genus with the recently described *Capromys geayi* Pousargues from Venezuela. Furthermore, the recent acquisition by the American Museum of a specimen of *Capromys brownii* (= *brachyurus* auct.) from Jamaica — the only example of this species, so far as I know, in this country — permits, for the first time, comparison of the Jamaican species with *Capromys thoracatus* (True) of Swan Island.

In the appended study of this material I recognize six species and one subspecies of *Capromys*. The arboreal species are grouped with the type of the genus, *Capromys pilorides*, under the genus and subgenus *Capromys ;* the terrestrial species are grouped, with *Capromys brownii* as the type, under a new subgenus, *Geocapromys*.

Capromys[1] *Desmarest.*

Capromys DESMAREST, Mém. Soc. d'Hist. Nat. I, Dec., 1822, 43. Type, *Capromys fournieri* Desm. = *C. pilorides* (Say).

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[1] For general papers on *Capromys* see the following:
Say, Journ. Acad. Nat. Sci. Phila., II, 1822, 232–343.
Desmarest, Mém. Soc. d'Hist. Nat., I, 1822, 43.
MacLeay, Zoöl. Journ., IV, 1829, pp. 269–278.
De la Sagra, Hist. Phys. de l'Ile de Cuba, Mammifères, pp. 11, 12 ; Atlas, pll. iii–viii.
Waterhouse, Nat. Hist. Mamm., II, 1848, pp. 286–294, pl. xii, pl. xiii, fig. 1.
Gundlach, Contribucion á la Mamalogia Cubana, Havana, 1877, pp. 44–47.
Dobson, P. Z. S , 1884, pp. 233–250, plls. xvii–xxi.
Allen, Bull. Am. Mus. Nat. Hist., III, 1891, pp. 329–336, figs. 1–10.

Isodon SAY, Journ. Acad. Nat. Sci. Phila. II, Nov. 1822, 332 (*nec Isodon* E. Geoffroy, 1806).

SUBGENUS *Capromys.*

1. *Capromys pilorides* (Say). Generally distributed throughout Cuba.
2. *Capromys prehensilis* Poeppig. Generally distributed throughout Cuba.
2a. *Capromys prehensilis gundlachi* nobis. Isle of Pines.
3. *Capromys melanurus* Poey. Eastern Cuba.

SUBGENUS *Geocapromys*, subgen. nov.

Similar to *Capromys* but tail short, little if any longer than the hind foot with claws; the claws of both hind and fore feet shorter than in *Capromys*, the inner toe of the fore foot barely evident; dentition and cranium as in *Capromys*, but the ascending maxillary arch of the zygoma wider, the superior margin of the squamosal narrower and without processes, the occipital region lower.

4. *Capromys brownii* Fischer. Jamaica.
5. *Capromys thoracatus* (True). Swan Island.
6. *Capromys ingrahami* Allen. Easternmost of Plana Keys, Bahamas.

Capromys pilorides.

Isodon pilorides SAY, Journ. Acad. Nat. Sci. Phila. II, Nov. 1822, 333.
Capromys fournieri DESM. Mém. Soc. d'Hist. Nat. I, Dec. 1822, 43.

This, the most common species of the genus, is represented by thirteen specimens; one is imperfect and four are unaccompanied by skulls. Four were collected in March, 1900, at El Guama, and one in April, 1900, at San Diego de los Baños, in western Cuba, by Messrs. Palmer and Riley for the U. S. National Museum; three were collected in March, 1892, at Trinidad, central southern Cuba, by the writer, for the American Museum of Natural History, and five specimens in the last-named museum died in captivity in zoölogical gardens. Only the skulls of the latter are used in the present connection.

Variations in Color.—The anterior parts of the face, the sides of the neck and upper surface of the fore legs vary in color from grizzled whitish with a very slight admixture of the color of the back, to black and fulvous, with only a slight sprinkling of white; the crown, nape, back, sides, and outer surface of the hind legs vary from black and pale buff to black and deep rusty; the tail is unicolor and varies from buff to deep rusty brown. In two specimens the underparts are uniform buffy whitish, in one the underparts, except the chin, which is grizzled, are black and rusty, nearly as dark as the color of the back ; the normal color appears to be about half way between these extremes. Practically the entire range of variation in color, thus briefly described, is shown in two specimens from El Guama, showing that it is not geographical ; the palest specimens in the series, however, are females, indicating a possible sexual difference in color.

Variations in Size.—Comparing only the six examples which, by cranial characters, are shown to be mature, variations in size are presented in the following table of measurements from fresh specimens :

Collection.	No.	Sex.	Total Length.	Tail.	Hind Foot.	Ear.
U. S. N. M.	103880	♀	730	170	97	
"	103882	♀	720	175	95	27
"	103885	♂	743	205	100	28
Am. Mus. Nat. Hist.	$\frac{4923}{3809}$	♂	710	237	90	
"	$\frac{4924}{3810}$ (1)	♀	810	255	100	
"	$\frac{4925}{3811}$	♂	800	200	95	

The Skull.—In skulls of presumably about the same age no noteworthy variation is observed, the enamel pattern of the molars being especially constant in outline.

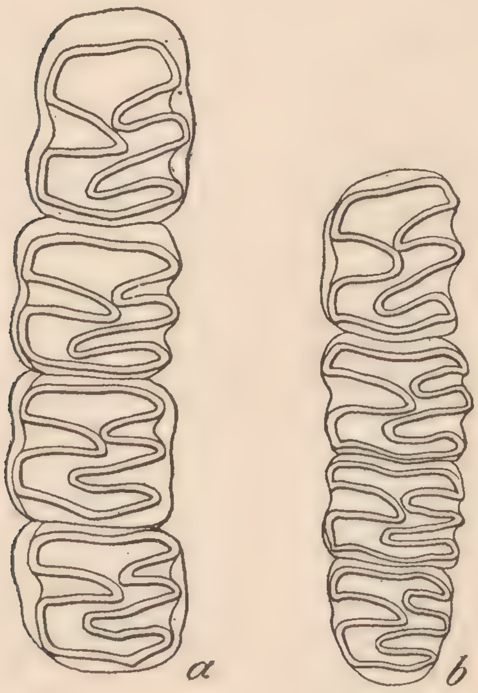

Fig. 1. *Capromys pilorides*, right upper molars, $\frac{2}{1}$. *a*, Am. Mus. $\frac{3811}{4925}$ ♂ ad. Trinidad, Cuba. *b*, Am. Mus. 16726, ♂ juv. N. Y. Zoöl. Society.

Two of the zoölogical park specimens are about half grown and their skulls, although in a more or less diseased condition, furnish some basis for the determination of variation in cranial characters with age in this species. As might be expected, the usual sutural changes, narrowing and raising of the sagittal crest, production of the supraorbital processes, etc., accompanying increased age, are to be seen, but it is especially to be noted that, so far as the present material is concerned, no change in the pattern of the enamel outline of the molars occurs with age. This is evident on comparison of the accompanying figures.

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(1) Contained 4 embryos, each about 19 mm. in length.

Capromys prehensilis *Poeppig.*

Capromys prehensilis Poeppig, Journ. Acad. Nat. Sci. Phila. IV, 1824, 11.
Capromys poeyi Guérin, Mag. de Zoöl. 1834, Cl. I, pl. xv.

This species is not represented in the American Museum, but through Mr. Miller's kindness I am permitted to examine an exceedingly beautiful and instructive series of thirteen specimens collected in Cuba by Messrs. Palmer and Riley. Five were secured at San Diego de los Baños in April, 1900, two at Cabañas in May, 1900, and six in the Isle of Pines in July, 1900. The latter prove to be separable from true *prehensilis*, as represented by the first-named specimens, and are described below under the name *Capromys prehensilis gundlachi*.

Variations in Size.—Two adults of true *prehensilis*, from San Diego de los Baños, measured in the flesh as follows:

Collection.	No	Sex.	Total Length.	Tail.	Hind Foot.	Ear.
U. S. N. M.	103888	♂	710	305	82	30
"	103890	♂	715	313	82	20

Variations in Color.—Five of the seven specimens of *prehensilis* are adult, two are young, one of them with only partially developed dentition. One of the adults is evidently an albino, its nearly uniform white pelage being only tinged with rufous, which is stronger posteriorly. The remaining four adults vary comparatively little in the coloration of the upper parts. The anterior parts of the head are soiled whitish more or less tinged with brown in three specimens, grayish brown in the fourth; the back is a mixture of black, buff, and ferruginous rufous present in varying proportions; the tail is bright ferruginous rufous in two specimens, light brown in the third, and nearly denuded of ferruginous rufous colored hair in the fourth. In the color of the underparts one specimen is creamy white, ferruginous rufous posteriorly, one creamy white with a brownish neck band, and two are whitish on the throat, and about the fore and hind legs, with the intervening areas mixed with brownish.

Two young specimens in soft pelage, taken at San Diego de los Baños April 8 and 20, respectively, resemble the adults in the coloration of the upper parts but have the head brown anteriorly and the tail wholly blackish. Below, one specimen is creamy white, and one is grayish with white on the throat, at the fore legs and about the vent. The differences in color here noted appear to be related neither to age, sex nor climate, and may therefore be considered as purely individual.

The Skull.— Although *Capromys prehensilis* is a much lighter, slenderer animal than *C. pilorides*, its longer tail disguises this fact, which is much more apparent on comparison of the skulls of these species. The skull of *pilorides* is about twice the bulk of that of *prehensilis*, and, as might be expected, is in consequence heavier and more massive throughout and with more strongly pronounced processes. There appears to be no difference in the enamel pattern of the molars.

In the younger of the two immature specimens of *prehensilis* already mentioned only the two anterior molars have as yet appeared and in them the enamel pattern is too imperfect to be clearly distinguished. In the other only the last molar has not as yet appeared above the border of the alveolus, but the three molars already acquired have fully developed enamel outlines. The two anterior molars agree in pattern with the corresponding teeth in the adult ; the third, or what for the time is the last molar, is rounded posteriorly with a corresponding change in the enamel outline, which thus more closely resembles the last (fourth) molar in the adult than its true representative, the third. There is thus a slight change in the outline of the enamel with age.

Capromys prehensilis gundlachi,[1] *subsp. nov.*

Char. Subsp.—Similar to *Capromys prehensilis* Poeppig but less ferruginous rufous in color, the zygomatic arch heavier, the postorbital processes less produced.

Description of the Skin of Type (No. 103905 U. S. Nat. Mus., ♂, Nueva Gerona, Isle of Pines, July 4, 1900, Palmer and Riley.)—Back and outer surface of the hind legs mixed buffy, black, and ferruginous, the two former predominating, except on the rump where the ferruginous is brightest ; the crown and cheeks browner without black, the nose and supraocular region buffy, the lower part of the cheeks whitish; upper surface of the fore legs grayer than the back and without black; sides of the body with less rufous than the median dorsal area; entire underparts, from the chin to the base of tail and including the lower (inner) surfaces of both front and hind legs, creamy white or buffy white; tail uniformly hairy with no bare space, mixed rufous and brownish black, the former prevailing on the basal third, the latter on the apical two thirds.

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[1] I have named this form in honor of the late Dr. Juan Gundlach, who, in spite of often adverse circumstances, pursued for over forty years his study of the Cuban fauna, and to whom, more than anyone else, we are indebted for our present knowledge of Cuban mammals and birds.

Measurements.—Total length, 695; tail, 300; hind foot, 80; ear, 23 mm.

Description of the Skull of Type (U. S. Nat. Mus., 103905, ♂).—Similar in dentition and general dimensions to the skull of *Capromys prehensilis* but with the malar and portion of maxilla adjoining the frontal and premaxilla wider, the squamosal heavier, its superior margin adjoining the frontal and parietal wider and more pronounced, especially anteriorly where it nearly fills the concavity in the outline of the frontal occasioned by the production of the postorbital process, the latter, however, less pronounced than in *prehensilis.*

Measurements.—Greatest length, 80.5; greatest width, 40; width at postorbital processes, 24.5; width of superior margin of the squamosal at parieto-frontal suture, 2.5; width of malar at the maxillary suture, 8.5; nasals, 22.5; frontal, 26.5; parietal, 28; molars, length of upper series, 11.5; width between inner margins of upper anterior molars, 3.5; distance from anterior margin of alveolus of first upper molar to posterior margin of the alveoli of the incisors, 20; height of lower jaw at condyle, 26.5; from tip of incisors to end of coronoid process, 60.5 mm.

Remarks.—Whether the range of individual variation in this form and *Capromys prehensilis* is sufficiently great to bridge the differences separating them the material in hand does not show, but in spite of the fact that geographical intergradation is impossible I describe the Isle of Pines animal under a trinomial designation, because, being the undoubted representative in that island of *C. prehensilis*, such a name best shows its derivation and, to a certain extent, the degree of its relationship.

Variations in Color.—Of the five additional specimens from the Isle of Pines two adult females agree essentially in the color of the upper parts with the type, but are somewhat more ferruginous posteriorly; both have the tail ferruginous, in one the color being darker than in the other, the basal inferior surface in each being blackish. In the color of the lower parts one of these specimens agrees with the type but has a slight brownish neck band, and some brownish on the inner side of the hind legs. In the adult female the throat, breast, a median abdominal line and the posterior parts of the abdomen are creamy whitish, the rest of the under surface being mixed with brownish.

Two immature females taken at Nueva Gerona, July 4, measure respectively 576 and 590 millimetres in total length, and agree closely with the type in color of the parts below, being slightly washed with brownish on the neck and abdomen ; in each the tail is uniform brownish black.

The sixth Isle of Pines specimen, as before remarked, is apparently albinistic.

Variations in Size.— The collector's measurements of the four adult specimens are given below :

Collection.	No.	Sex.	Total Length.	Tail.	Hind Foot.	Ear.
U. S. N. M.	103901	♂	705	295	80	20
"	103902	♀	666	260	75	25
"	103904	♀	705	295	80	22
"	103905[1]	♂	695	260	73	19

Variations in the Skull.— The skulls of three adult specimens — the fourth being without a skull — agree closely in form, and in each the cranial characters attributed to the Isle of Pines race are well marked. Particularly is this true of the superior margin of the squamosal, which, as shown by the accompanying plate (Pl. XXXIX), is much more prominent than in true *prehensilis ;* and in the immature specimens above mentioned this character is also present.

In the enamel pattern of the molars, these young specimens resemble the adults, as is shown by the accompanying figure.

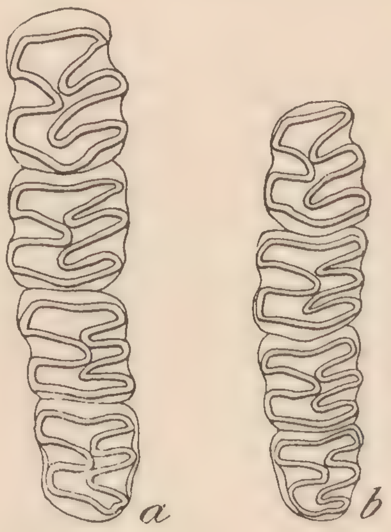

Fig. 2. *Capromys prehensilis gundlachi*, right upper molars, $\frac{2}{1}$. *a*, U. S. N. M., 103905, ♂ ad. Isle of Pines. *b*, U. S. N. M. 103903, ♀ juv. Isle of Pines.

Capromys melanurus *Poey.*

Capromys melanurus Poey, M-B. Akad. Berlin, 1864, 384 ; Dobson, P. Z. S. 1884, 234, plls. xviii–xxi.

Of this little-known species I have only the skin of two heads with their skulls, presented to the American Museum by the late

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[1] Type.

Dr. Gundlach. They are without date, sex, or exact locality; one is adult, but not aged, the other somewhat immature. In the older the hair is mixed sooty brown and whitish, browner on the nose, blacker on the nape and changing to sooty grayish on the chin and throat. In the younger there is less whitish, the face being nearly uniform sooty brown.

Comparison of the skull (Am. Mus. No. 7980) of the older animal with a skull of *C. prehensilis*, of apparently the same age, shows very slight differences. The superior margin of the squamosal is even less pronounced in *melanurus* than in *prehensilis*, the supraorbitals are also less prominent, but these differences may be individual, and the characters separating *melanurus* from *prehensilis* are doubtless to be found in the much blacker color of the former, in the softer hair, and greater hairiness of the tail, which is said by Dobson to be penicillate for nearly an inch.

Capromys brownii *Fischer.*

Capromys brownii FISCHER, Synop. Mamm. Adden. 1830, 389 [= 589], based on the "Small Indian Coney" of Brown's Hist. Jamaica, 1770, p. 484.

Capromys brachyurus HILL in Gosse, Naturalist's Sojourn in Jamaica, 1851, 471, and of authors generally.

In June, 1900, Mr. Francis C. Nicholas presented the American Museum with an adult male of this now rare species which he had himself lately secured in Jamaica. In the coloration of the upper parts this specimen closely agrees with the darker colored examples of *Capromys pilorides*, but the hair is finer and less than half the length of that of *pilorides*; below it is a uniform dusky brown. The measurements of the dried skin are: Total length, 450; tail, 35; hind foot, 60; ear from crown, 6 mm. The latter measurement is doubtless affected by the nature of the specimen, nevertheless the ear is evidently much smaller than in any other species of the genus.

The skull, of which a figure is presented (Pl. XL), shows this specimen to be an aged adult, and in connection with the size of the species it therefore presents the cranial characters of the short-tailed members of the genus, which are here grouped under the subgeneric title *Geocapromys*, in a highly developed degree. Compared with the skulls of the two other members of its subgenus, apart from its greater size, and allowing for differences in age, the absence of supraorbital processes, the relatively greater width at the interorbital constriction, the narrowness and relative greater height of the condyle of the lower jaw are noticeable. The measurements are : greatest length, 82 ; greatest width, 45 ; width at interorbital constriction, 19.5 ; width of malar at the maxillary suture, 10 ; least width of the ascending maxillary arch of the zygoma, 5.5 ; nasals, 28 ; frontal, 29 ; parietal, 24.5 ; length of upper molar series, 18.5 ; width between inner margins of first upper molars, 2 ; distance from anterior margin of first upper molar to posterior margin of the alveoli of the incisors, 19.5 ; height of lower jaw at condyle, 24.5 ; least width of condyle, 6 ; distance from tip of incisors to end of coronoid process, 63.5 mm.

Dr. Allen calls my attention to the fact that Fischer's name for this species antedates that of Hill by twenty-one years.

Capromys thoracatus (*True*).

Capromys brachyurus thoracatus TRUE, Proc. U. S. Nat. Mus. XI, 1888, 469.

The acquisiton of the above-mentioned specimen of *C. brownii* (= *brachyurus* auct.) permits, for the first time, actual comparison of *thoracatus* with the form to which it has generally been supposed to be subspecifically related. The result shows the two animals to differ widely from each other in color, dimensions, particularly of the ears, and in cranial characters. In fact, *thoracatus* proves to be much more closely related to *ingrahami*, from which indeed it is to be distinguished externally only by size, the two known specimens of *thoracatus* agreeing exactly in color with the prevailing type of *C. ingrahami* as it is shown by a series of twelve specimens in the American Museum. In the absence of measurements from fresh specimens a satisfactory comparison of the two animals as regards size is not possible, but reference to the life-sized figures (Pl. XL) of their skulls here presented gives a fair idea of their proportions. In short, *thoracatus* and *ingrahami* are evidently representatives of the same form, perhaps of one of the species of *Capromys* which, we learn from the writings of Columbus and Oviedo, inhabited Hayti at the time of its discovery.

Capromys ingrahami *Allen.*

Capromys ingrahami ALLEN, Bull. Am. Mus. Nat. Hist. III, 1891, 329, figs. 1–10.

I can add nothing to Dr. Allen's description of the series of *Capromys ingrahami* secured by the American Museum from its discoverer. Comparison, however, with the specimen of *C. brownii*, received by the Museum since *ingrahami* was described, shows that the latter has no specific relationships with the former.

"Capromys" geayi *Pousargues.*

Capromys geayi POUSARGUES, Bull. Mus. d'Hist. Nat. 1899, p. 150.

Capromys geayi, described by Pousargues from the mountains between La Guayra and Caracas, Venezuela, I consider as closely related to, but generically distinct from, the West Indian species of *Capromys*, and therefore place it in a new genus which may be characterized as follows :

Procapromys, gen. nov.

Size smaller than the smallest known species of *Capromys ;* tail half as long as the body ; ear half as high as the length of the hind foot without the claws ; enamel outline in first three upper molars continuous, with two external and one internal folds ; the fourth — last molar — with three distinct and disconnected transverse enamel ellipses, the posterior one about half the size of either of the anterior two ; enamel outline in the four lower molars continuous, the first molar with three internal and one external folds, the first and second interior folds being more extended than in the corresponding tooth of *Capromys ;* the remaining three lower molars each with two internal and one external fold, the enamel enclosed space on the posterior margin of the last molar being scarcely wider than the enamel itself.

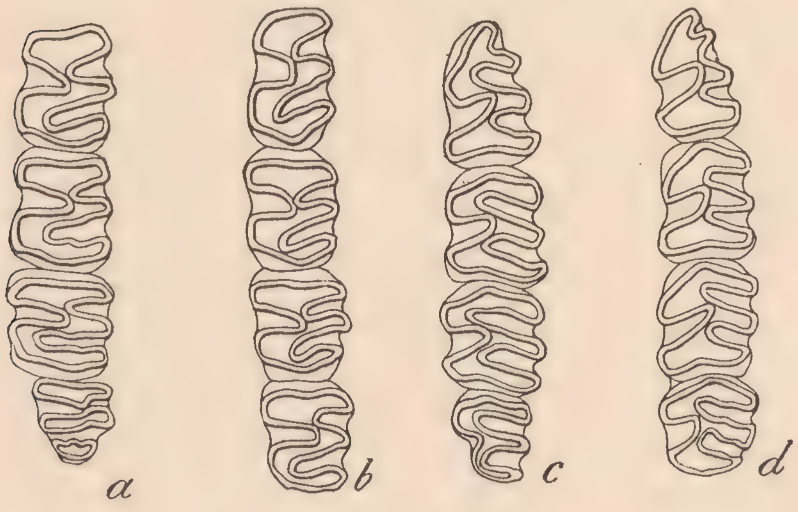


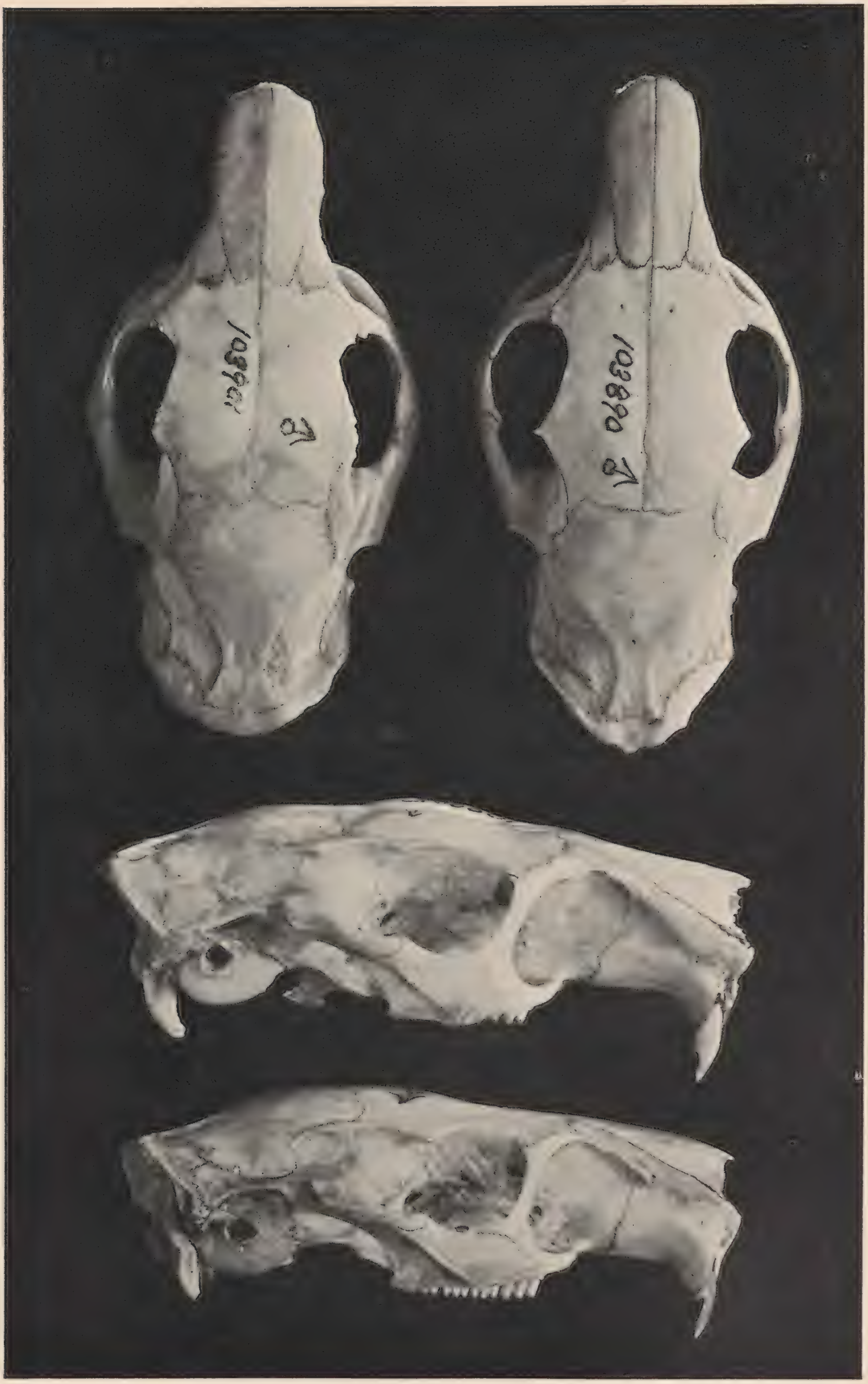
Fig. 3. *a*, *Procapromys geayi*, right upper molars ; *b*, *Capromys ingrahami*, right upper molars ; *c*, *Procapromys geayi*, left lower molars ; *d*, *Capromys ingrahami*, left lower molars. All twice natural size. After Pousargues.

Type, *Capromys geayi* Pousargues.

Without examination of the type and only known specimen of *pro-*

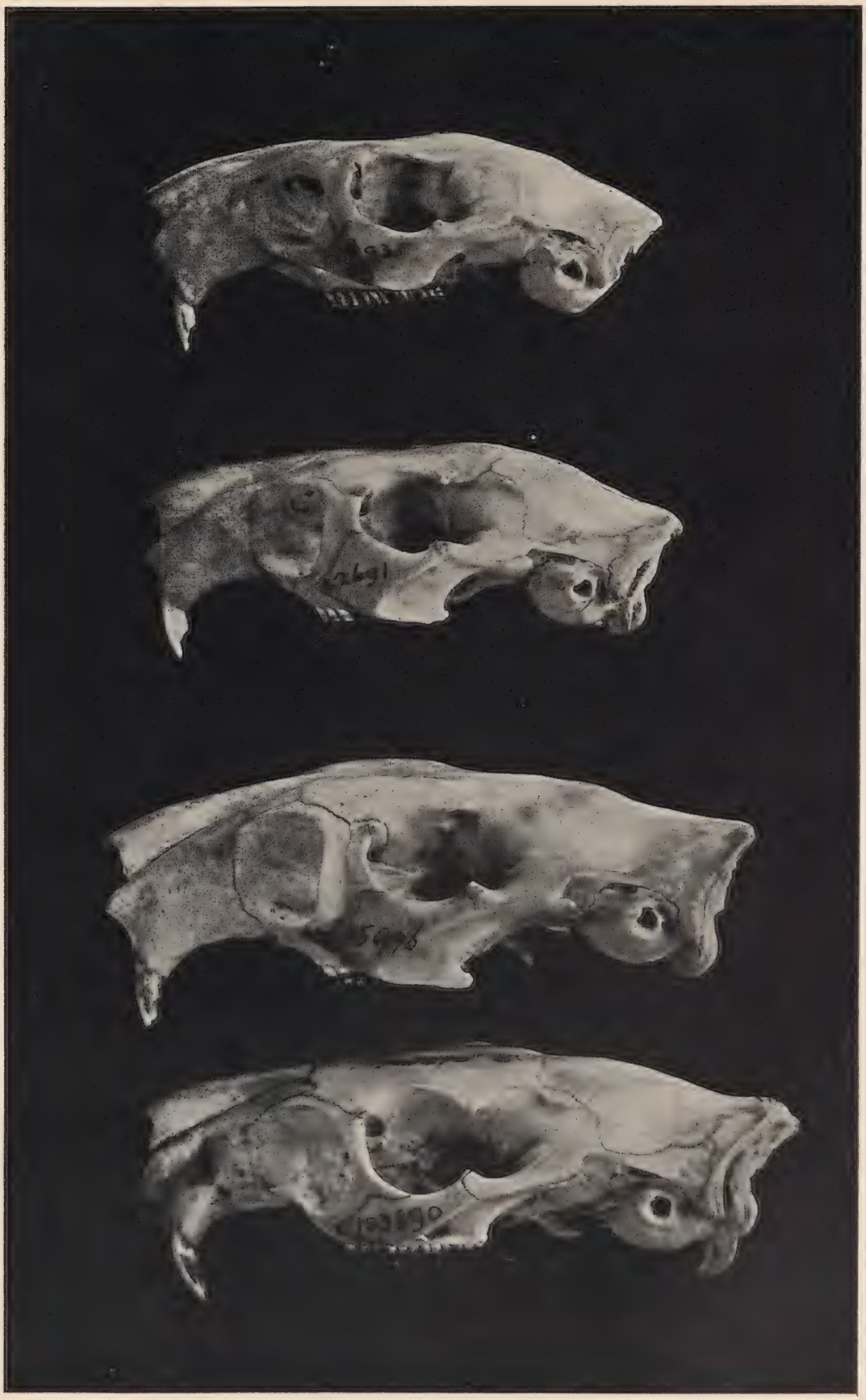
capromys geayi a satisfactory diagnosis of its generic characters is impossible, but M. Pousargues's excellent description and figures of the dentition doubtless enable one to determine its most salient features. In view of the remarkable constancy of the enamel pattern in *Capromys*, even when the most unlike members of the genus are compared, the difference in the enamel outline of the last lower molars in *Capromys* and *P. geayi* is of much importance and, in connection with the characters mentioned above, seems to warrant the generic distinction here proposed. M. Pousargues attributed this difference to the probable immaturity of his specimen, but, as the material at hand abundantly proves, there is no essential difference with age in the enamel pattern of *Capromys.*

The importance of the discovery of *geayi* is by no means affected by this proposed change in names. It quite probably represents the ancestral mainland type whence *Capromys* descended



No. 103901, ♂, U. S. Nat. Mus., *Capromys prehensilis gundlachi*.
No. 103890, ♂, U. S. Nat. Mus., *Capromys prehensilis*.

Upper profile figure, No. 103905, ♂, U. S. Nat. Mus., *Capromys prehensiiis gundlachi*, type.
Lower profile figure, No. 103892, ♂, U. S. Nat. Mus., *Capromys prehensilis*.



No. 3035, Am. Mus., *Capromys ingrahami.*
No. 22691, U. S. Nat. Mus., *Capromys thoracatus*, type.
No. 15976, Am. Mus., *Capromys browni.*
No. 103890, U. S. Nat. Mus., *Capromys prehensilis.*

The three upper figures show the skulls of the known members of the subgenus *Geocapromys ;* the lower figure shows the skull of a typical member of the subgenus *Capromys.* Compare, especially, the ascending arch of the maxillary.

Article XXII.—THE GENERIC NAMES OF THE MEPHITINÆ.

By J. A. Allen.

In Mr. Arthur H. Howell's recent 'Revision of the Skunks of the Genus *Chincha*'[1] radical changes are made in the nomenclature of the North American Skunks, which involve a complete overturning of the generic names of the North American Mephitinæ. *Chincha* Lesson is adopted for the group hitherto known as *Mephitis*, and *Mephitis* is transferred to the Little Striped Skunks known of late as the genus *Spilogale*, the latter name becoming a synonym of *Mephitis*. As *Thiosmus* Lichtenstein, 1838, is adopted for the Bare-nosed Skunks of Mexico and the southern border of the United States,—*Conepatus* Gray, 1837, being restricted to the South American species,—the hitherto current generic names of all the Skunks found north of Panama are changed. Mr. Howell's paper is in other respects such an admirable piece of work that it is all the more to be regretted that the changes in the generic names affecting *Mephitis* and *Spilogale* rest on a faulty basis.[2]

Mr. Howell's reasons for accepting *Chincha* in place of *Mephitis* are as follows:

"Lesson proposed this as the name of a subgenus of *Mephitis*, with *Chincha americana* as the type species; *hudsonica* Richardson is given as a variety, but no other species are placed in the group. The references show that his type species is based on *Viverra mephitis* Erxleben, which in turn is based on *V. mephitis* Schreber —a plainly recognizable species. If we assume (as we can with all propriety) that Cuvier, in placing '*Viverra mephitis* L.' as one of the types of his genus *Mephitis* referred to *V. mephitis* of Gmelin's edition, we then have for the type of *Chincha* a species which is one of the two originally composing the Cuvierian genus *Mephitis*, and one that is likewise identifiable, for *V. mephitis* Gmelin is based on *V. mephitis* Schreber.

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[1] 'North American Fauna,' No. 20, pp. 1–62, pll. i–viii. Aug. 31, 1901.

[2] At this point, in justice to Mr. Howell, it seems proper to confess my own shortcoming in the matter. When in Washington last April I not only learned of the conclusion Mr. Howell had reached regarding the generic names of the Skunks, but I was consulted as to whether some way could not be devised whereby such a lamentable *bouleversment* might be avoided. I had then neither the time nor opportunity for a proper investigation of the points at issue, but on returning to New York, I carefully reviewed, by Mr. Howell's request, the pros and cons of the case as then understood. The chief question was whether or not Gray's sections *a* and *b* of *Mephitis* (Charlesworth's Mag. Nat. Hist., I, 1837, p. 581) could be construed as restricting *Mephitis* to the North American large Skunks, on account of his later giving the name *Spilogale* to his section *b* (P. Z. S., 1865, p. 150). I then wrote to Mr. Howell that I saw no escape from the proposed changes involving the terms *Mephitis*, *Chincha*, and *Spilogale*. Unfortunately, however, the real points at issue were wholly overlooked. In posting my MS. card catalogue of American Mammals soon after the publication of Mr. Howell's paper, I was astonished on looking up the various questions of nomenclature involved to find that *Chincha* of Lesson was a synonym of the restricted genus *Mephitis*. It seems strange, and is lamentable, that this point should have been previously overlooked by both Mr. Howell and myself.

"It is perfectly clear, therefore, that Lesson intended to apply the name *Chincha* to the large two-striped North American skunks, and it is used for these in a generic sense in the present paper."

The whole question thus depends on the supposed availability of Lesson's generic name *Chincha* for the North American large skunks, while this in turn, according to Mr. Howell, rests solely on the applicability of *Viverra mephitis* of Schreber to some of the several species occurring in North America. In reality, however, *Viverra mephitis* of Gmelin and Schreber has no important bearing on the case of *Chincha* since *Mephitis*, in a restricted sense, had already been twice assigned to the large two-striped skunks of North America before *Chincha* was proposed.

THE GENUS *Mephitis* CUVIER.

The genus *Mephitis*, as is well known, was established by Cuvier for the 'Mouffettes,' in the first 'tableau' of his 'Leçons d'Anatomie Comparée,' published in the year 1800, and is equivalent to his division *c* of *Mustela* of his 'Tableau élémentaire de l'Histoire naturelle des Animaux' (p. 116) of two years' earlier date. He there designated the group simply as 'Les Mouffettes,' and placed in it only two species, as follows :

"11. Le conepate. (*Must. putida.*) *Viverra putorius* L."
"12. Le chinche. (*Must. mephitis.*) *Viverra mephitis* L."

The first is evidently, by the diagnosis and the synonomy, the *Viverra putorius* of Linnæus and Gmelin, based primarily on Catesby and Kalm, here renamed *Mustela putida*. It has long been my opinion that *Viverra putorius* Linn. is referable, if to anything, to the large skunks of eastern North America and not to the little striped skunks, as some have claimed. As stated by Bangs (Proc. Bost. Soc. Nat. Hist., XXVIII, 1898, p. 223), it is composite, being apparently "a combination of *Mephitis mephitica* and *Spilogale ringens*." Catesby's figure, however, has little resemblance to either, and may fairly be considered as drawn off-hand from a confused recollection of these two animals, and hence factitious. His figure has been copied time and again by later compilers, who have accompanied it by descriptions obviously based on the figure rather than on anything in nature. Even Kalm, who knew personally the skunks of Pennsylvania and the country thence northward, seems to have taken his account of its external features mainly from Catesby's figure. His general account of the animal was obviously based only slightly on personal observation, and mainly on information derived from the people among whom he lived or travelled ; it of course relates to the common large skunk of Pennsylvania, New Jersey, and perhaps New York, as he was apparently never within several hundred miles of the region of *Spilogale.* The *Viverra putorius* of Schreber, Erxleben, and Gmelin, and the 'Striated Weesel' of Pennant all have practically the same basis, namely, Catesby and Kalm.

Cuvier's 'Conepate,' there is every reason to believe, is 'le conepate' of Buffon (Hist. Nat., XIII, 293), who first employed the name in a technical sense. Buffon says : " Le conepate a sur un fond de poil noir cinque bandes blanches qui s'étendent longitudinalement de la tête à la queue." In a footnote he gives a long extract from Kalm, and cites no other author. Cuvier's diagnosis is practically identical with Buffon's, and Gmelin's is not materially different, all being based primarily on Catesby and Kalm. Kalm identified his animal with that described and figured by Catesby, and says : "Dr. Linnæus calls it *Viverra putorius.*" Thus Cuvier's Conepate — which he here names *Mustela putida*, and identifies with Linnæus's *Viverra putorius* — is, there is every reason to suppose, the animal so called by Buffon, namely, the common skunk of eastern Pennsylvania described by Kalm, and not a species of *Spilogale.*

Cuvier's second species of Mouffette is 'le chinche,' his short diagnosis being obviously based on 'le chinche' of Buffon. Although he refers to it as found throughout America, his only reference is to Fueillée, who describes a skunk from southern South America, and hence a species of *Conepatus.* Buffon's figure and brief diagnosis (Hist. Nat., XIII, p. 294 and pl. xxxix), and Daubenton's description (*l. c.*, p. 300), however, appear to have been based on a North American specimen of true *Mephitis*, as will be noticed more fully later in discussing *Viverra mephitis* Schreber. We thus find that neither of Cuvier's two species of Mouffette is involved with *Spilogale.*

This is quite contrary to the conclusion reached by Mr. Howell (*l. c.*, p. 14), who says the removal in 1842 by Lesson of Cuvier's first species to become the type of *Chincha* leaves his second species (the Conepate), "one of the little spotted skunks, as the type of *Mephitis*"; and that "the name *Spilogale*, proposed in 1865 by Gray for the little spotted skunks, will therefore have to be abandoned, becoming a synonym of *Mephitis*." His conclusion in regard to *Spilogale* is, as shown above, obviously erroneous, the fact being that Cuvier's original genus *Mephitis* in no way or manner included any member of Gray's later genus *Spilogale.*

The first effective revision of *Mephitis* was made by Gray in 1837 (Charlesworth's Mag. of Nat. Hist. and Journ. of Zoöl., etc., I, 1837, p. 581), when he removed the bare-nosed skunks of South America to form his genera *Conepatus* and *Marputius*, and restricted *Mephitis* to the large skunks of North America. At the same time he also divided *Mephitis* into two groups, designated as *a* and *b*, placing in the former only two species (described as new) of the large two-striped skunks, and in the latter a single species of the little spotted skunks, described as new under the name *Mephitis bicolor.*

In 1865 (P. Z. S., 1865, pp. 150) he named his section *b Spilogale*, with *Mephitis interrupta* Rafinesque as the type and only species, to which he refers his own *M. bicolor*, the only species placed in his section *b* in 1837; *Conepatus* is retained exclusively for the South American large skunks, and *Marputius* is properly assigned as a synonym of *Conepatus.* The dismemberment of the old genus *Mephitis* thus made by Gray was not only based on a proper recognition of the facts in the case, but has stood without question until Mr. Howell brought forward the case of *Chincha* Lesson.

Lichtenstein, in 1838, in his elaborate and excellent memoir 'Über die Gattung *Mephitis*' [Abhandl. der Königl. Akad. der Wissensch. zu Berlin, Phys. Klasse, 1836 (1838), pp. 249–313, pll. i, ii], divided the genus *Mephitis* into two subgenera, namely, *Thiosmus* (*l. c.*, p. 270), for the bare-nosed skunks of Mexico and

South America, and "*Mephitis* Cuv. *s. str.*" (*l. c.*, p. 276), for the North American skunks collectively, including the forms later separated by Gray as *Spilogale.* Lichtenstein's *Thiosmus* is thus the equivalent of Gray's *Conepatus* and *Marputius* combined, both of which terms he rejects on account of their being such barbarous distortions ("solch barbarische Verzerrungen"). His restricted subgenus *Mephitis*, more explicitly than Gray's restricted genus *Mephitis*, covers all the then known North American skunks not referable to the previously established genus *Conepatus.* The later removal by Gray in 1865 of the little striped skunks to form the genus *Spilogale* was therefore a perfectly proper and tenable proceeding, while Lesson's attempt to establish a genus *Chincha* in place of the previously properly restricted *Mephitis* was wholly unjustifiable and ineffective. Although Lesson had Lichtenstein's able exposition of the skunks for a guide, he could hardly have made a worse jumble of the group, as regards either the 'subgenera,' species, or nomenclature.

Lesson's restricted 'sous-genre' *Mephitis*, consisting of three species, includes one each of the present genera *Conepatus*, *Mephitis*, and *Spilogale*, in the order named, his first being a pure synonym of his first species of *Thiosmus;* his second, if it can be identified at all, is Buffon's Conepate, and hence, as already explained, is the form of *Mephitis* occurring in Pennsylvania and New Jersey; while the third is Rafinesque's *Mephitis interrupta*, and hence a *Spilogale.*

THE GENUS *Spilogale* GRAY.

As Lesson's action in proposing *Chincha*, and his consequent transference of *Mephitis* to a group which by chance included a species of *Spilogale*, is void, the erection of the genus *Spilogale* by Gray in 1865 was, as already said, a perfectly legitimate proceeding.

In this connection it is interesting to trace the history of the first recognizable species of *Spilogale.* This proves to be the *Viverra zorilla* Schreber (Säug., III, 1776, p. 445, pl. cxxiii), based primarily on 'le zorille' of Buffon (Hist. Nat., XIII, pp. 289, 295, pl. xli), the description being from Daubenton (Buffon, *l. c.*, p. 302), and the plate an accredited copy of Buffon's. Buffon tells us he gave it the name zorille, "qu'elle porte au Pérou et dans quelques autres endroits des Indes espagnoles." The description and figure indicate beyond question a species of *Spilogale*, but the locality is, of course, not Peru, but probably Mexico. G. Cuvier wrongly claimed[1] that Buffon's plate represents "un animal du Cap de Bonne-Espérance, que Buffon a mal-à-propos considéré comme propre à l'Amérique"; and this is doubtless why he in his 'Tableau élémentaire de l'Histoire naturelle des Animaux' (p. 116), published three years before the date of this note, placed the "*Viverra zorilla* Lin." (= Gmelin) in his group '*b*, *Martes*,' instead of with the Mouffettes, thus formally excluding the only then known species of *Spilogale* from his group *c*, 'les Mouffettes,' which two years later became his genus *Mephitis*.

The next species of *Spilogale* to be made known, and the first definite and distinct mention of any form of *Spilogale* under *Mephitis*, is the *Mephitis interrupta* Rafinesque, described in 1820.

THE *Viverra mephitis* SCHREBER.

As Mr. Howell has adopted the specific name *mephitis* for the Canada Skunk, in the belief that Schreber's *Viverra mephitis* relates to this form, it seems desirable to consider its character.

Viverra mephitis of Schreber (Säug., III, 1776, p. 444, pl. cxxi) was based primarily and almost exclusively on the animal described and figured by Buffon and Daubenton as 'le chinche' (Buffon, Hist. Nat., XIII, pp. 294, 300, pll. xxxix). That the basis of *Viverra mephitis* Schreber is Buffon's 'le chinche' is shown:

(1) By Schreber's description, which is a slightly abridged paraphrase of Daubenton's description of that animal (Buffon, *l. c.*, p. 300), and it is duly accredited to Daubenton by Schreber.

(2) Schreber's plate is an avowed copy of Buffon's (see list of plates, p. 588 of Vol. III of Schreber's Säug.).

(3) The vernacular name employed is "der Chinche," showing further the particular animal he had in view.

Schreber cites three previous authors, namely, Linnæus, Buffon, and Pennant. He cites Linnæus as follows:

> "Viverra mephitis. LINN. *syst. nat. ed. 10. p. 44. n. 2.* Die Beschreibung gehört hieher, nicht aber die Namen."

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[1] Azara's Essais sur l'hist. Nat. des Quadr. de la Prov. du Paraguay, I, 1801, pp. 238, 239 (note on Azara's account of his Yagouaré).

Viverra mephitis should hence read *memphitis*, not *mephitis.* The name *Viverra mephitis* is thus not Schreber's, but merely his emendation of the Linnæan name *memphitis*, as shown by his use of the name on the plate and in the list of plates on p. 588, where he says: "*Viverra mephitis* Linn."[1] As is well known, the Linnæan *Viverra memphitis* is based on the "Ysquiepatl" of Hernandez, which, as already explained by Mr. Bangs (Proc. Boston Soc. Nat. Hist., XXVI, 1895, p. 351), is a compound of the Mexican Coati and some Mexican Skunk, as likely to have been a *Conepatus* or a *Spilogale* as a *Mephitis.* In any case, the name has long been ruled out as unavailable in nomenclature.

(2) Buffon is cited as follows:

"Chinche. BUFF. *13 p. 294. tab. 39.*"

(3) The reference to Pennant is given thus:

"Skunk weesel. PENN. *syn. p. 233. n. 167.* mit Ausschluss der Anführung des Kalm."

He thus excludes an important part of Pennant, since Kalm unquestionably wrote of the common large skunk of eastern North America. It is also to be noted in this connection that he follows Linnæus in again citing Kalm under his *Viverra putorius*, which is also a Linnæan name. Pennant's 'Skunk Weesel' is well known to be composite, relating collectively to the then known skunks of both North and South America. Of its range, Pennant says: "Inhabits *Peru*, and *North America*, as far as *Canada.*"

From the foregoing it will be seen that what there is in Schreber's *Viverra mephitis* relating to North America are certain references given by Pennant (not otherwise cited by Schreber), and his reference to Buffon's chinche. Respecting the geographical distribution of this animal Buffon explicitly states that it appertains to the hottest climates of South America, and is not found in New Spain, Louisiana, Illinois, and Carolina, as shown by the following transcript from Buffon's article: "De ces quatre espèces de mouffettes, que nous venons d'indiquer sous les noms de *coafe*, *conepate*, *chinche* & *zorille*, les deux dernières appartiennent aux climats les plus chauds de l'Amérique méridionale, . . . Les deux premiers sont du climat tempéré de la nouvelle Espagne, de la Louisiane, des Illinois, de la Caroline, &c."

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[1] Doubtless Schreber, as have most authors since his day, considered *memphitis* as a typographical error for *mephitis*. As to whether Linnæus purposely wrote *memphitis*, see Howell, *l. c.*, p. 18.

It must, however, be conceded that Buffon's brief description and plate, and the fuller description by Daubenton, indicate an animal with a head wholly black except a white longitudinal stripe on the front, which shows that the specimen in hand could not, so far as we now know, have come from South America. Both 'le chinche' and 'le zorille' were described and figured from poorly stuffed skins in the cabinet of "M. Aubry, Curé de Saint Louis," in Paris (*cf.* Buffon, *l. c.*, p. 289), without definite indication of the country whence they came, although Buffon evidently supposed they both came from either Peru or some part of the Spanish possessions in America ("nouvelle Espagne"). The most logical conclusion is that both came from Mexico and that 'le chinche,' and consequently Schreber's *Viverra mephitis*, is referable to *Mephitis macroura* Licht. rather than to any species from the United States or Canada.

SUMMARY.

To summarize the foregoing rather intricate discussion, the leading points may be thus stated :

1. *Mephitis* Cuvier was restricted to the large two-striped skunks and the little striped skunks of North America by Gray in 1837, through the removal of the bare-nosed skunks of Mexico and South America to form the genus *Conepatus*.

2. *Mephitis* was again restricted by Lichtenstein in 1838 by explicitly limiting the Cuvierian *Mephitis* to the North American large and small skunks, and proposing *Thiosmus* for the bare-nosed skunks, *Thiosmus* thus becoming a synonym of *Conepatus*, discarded on account of the barbarous origin of the word.

3. Consequently when *Chincha* was proposed by Lesson in 1842, ostensibly for the large two-striped skunks of North America, it became a synonym of *Mephitis* as previously restricted by both Gray and Lichtenstein.

4. The transference of *Mephitis* by Lesson in 1842 to a heterogeneous group, the last species of which chanced to be *Spilogale*, was hence void.

5. No identifiable species of *Spilogale* was included in the

Cuvierian genus *Mephitis;* the only species of *Spilogale* known to Cuvier in 1788 was referred by him to his group 'Martes' and excluded from his group 'les Mouffettes'; hence *Mephitis* could not later be transferred to the *Spilogale* group.

6. *Viverra memphitis* Linn. is a compound of the Mexican Coatis and Mexican Skunks, and is not citable as a term entitled to consideration in nomenclature; and it has been generally so treated by authors.

7. *Viverra putorius* Linn. is based primarily on Catesby's figure and description of his *Putorius americanus striatus*, neither of which is entitled to serious consideration; they must have been based, to take the most charitable view of the case, on a confused recollection of the little spotted skunk and the common skunk, and not on any animal he ever met with in nature.

8. If Linnæus's reference to Kalm is to have weight, his *Viverra putorius* would have to be referred to the common skunk, a proceeding as unwarranted as it would be undesirable. Hence, it would be better to treat the name as uncitable, and as thoroughly unavailable in nomenclature as is Linnæus's *Viverra memphitis*.

9. *Mustela putida* Cuvier, 1798, based on the Pole-cat of Kalm, antedates *Mephitis putida* Boitard, 1842, for the same animal.

10. *Viverra mephitis* Schreber, 1776, relates primarily to some species of Howell's subgenus *Leucomitra*, probably *Mephitis macroura* Licht., and not to the skunk of eastern Canada. It cannot, however, be positively identified.

SPECIES AND SUBSPECIES OF THE GENUS *Mephitis*.

Accepting Mr. Howell's excellent revision of the skunks of this genus as fairly representing our present knowledge of the group, the species and subspecies will stand as follows, the specific and subspecific names being those employed by Mr. Howell, except in the case of *Mephitis mephitica* Shaw and *Mephitis putida* Boitard.

SUBGENUS *Mephitis*.

1. Mephitis mephitica (*Shaw*).[1]
2. Mephitis hudsonica (*Rich.*).
3. Mephitis putida (*G. Cuv.*).[2]

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[1] As restricted by Bangs. Not *Viverra mephitis* Schreber, as supposed by Mr. Howell.

[2] *Mustela putida* G. Cuvier, 1798, which thus antedates *Mephitis putida* Boitard, 1842. It seems quite probable that Boitard took his name from Cuvier.

4. Mephitis elongata (*Bangs*).
5. Mephitis mesomelas (*Licht.*).
6. Mephitis mesomelas avia (*Bangs*).
7. Mephitis mesomelas varians (*Gray*).
8. Mephitis estor *Merriam.*
9. Mephitis occidentalis *Baird.*
10. Mephitis occidentalis spissigrada (*Bangs*).
11. Mephitis occidentalis notata (*Howell*).
12. Mephitis occidentalis major (*Howell*).
13. Mephitis occidentalis holzneri *Mearns.*
14. Mephitis platyrhina (*Howell*).

SUBGENUS *Leucomitra* HOWELL.

15. Mephitis macroura *Licht.*
16. Mephitis macroura milleri (*Mearns*).
17. Mephitis macroura vittata (*Licht.*).

Article XXIII.—CATALOGUE OF THE BINNEY AND BLAND COLLECTION OF THE TERRESTRIAL AIR-BREATHING MOLLUSKS OF THE UNITED STATES AND TERRITORIES IN THE AMERICAN MUSEUM OF NATURAL HISTORY, WITH ENUMERATION OF TYPES AND FIGURED SPECIMENS, AND SUPPLEMENTARY NOTES.

By L. P. Gratacap.

With Six Maps (Plates XLI–XLVI).

The Binney and Bland Collection of the Land Shells of the United States came into the possession of the American Museum in 1882. The importance of this well-known collection, containing some of the types and many of the specimens figured in 'The Terrestrial Air-Breathing Mollusks of the United States,' its association with the labors of three distinguished malacologists, and its excellent state of preservation warrant the publication of the present list; it being of interest and often important to know where may be found the types, figured specimens and other authentic material used as the basis of publications so authoritative as the works of Binney and Bland.

No attempt is made to give in this paper the synonymy or references to published descriptions of the species, the careful work of W. G. Binney (Bulletin of the U. S. National Museum. No. 28. A Manual of American Land Shells. Washington, 1885.), having rendered such matter entirely superfluous. While in some particulars the statements of Mr. Binney's 'Manual' may be subjected to slight rectification, his bibliography seems nearly complete. Mr. Binney's unrivaled acquaintance with American land shells and their literature is, of course, well understood.

The publication of this Catalogue seems also desirable on account of the register of specimens, printed in the appendix to Binney's 'Manual,' known as the "Binney Collection," presented to the U. S. National Museum by W. G. Binney, and also with reference to the specimens designated as the "Smithsonian Collection," and given in Binney and Bland's 'Monograph and Manual of Land and Fresh Water Shells,' Part I, published by the Smithsonian Institution in 1869.

The present Binney and Bland collection is distinct from either of these, and perhaps surpasses them both in historical and scientific interest. It includes the specimens used by Amos Binney and Augustus A. Gould in the preparation of their 'Terrestrial Air-Breathing Mollusks of the United States,' with which W. G. Binney incorporated his own specimens, and later the cabinet of his life-long co-worker and friend, Thomas Bland. It was used by Binney in the preparation of Vol. V of 'The Terrestrial Air-Breathing Mollusks of the United States,' published at Cambridge (July, 1878), as Vol. IV of the 'Bulletin' of the Museum of Comparative Zoölogy, and has been examined and commented on by many eminent students of this subject. It is thus in a high degree a historic collection.

In a letter to the writer Mr. W. G. Binney thus refers to these important collections: "The two collections (Binney and Bland) combined form the most valuable series illustrating the subject — such a series as never again can possibly be made, owing to my large correspondence with all the original authors, which enabled me to obtain their types as well as my own, my father's and Mr. Bland's — and valuable also from the care I took to collect specimens from every locality of every species."

The number of specimens now existing in the collection is in all cases accurately stated. In the references to the types and figured specimens the following abbreviations are employed:

T. M. = Terrestrial Air-Breathing of the United States, Vols. I–V, 1851–1878.

L. S. N. A. = Land and Fresh Water Shells of North America, Pt. I, 1869.

The nomenclature, with few exceptions, is that employed by Binney and Bland in labeling the collection. It is obviously at variance, in many ways, with modern lists, as that of such a master systematist as Pilsbry. But it seemed appropriate to leave the nomenclature as recorded on the specimens, for there can be no difficulty in determining its exact relationship to Pilsbry's latest compilation (Nautilus, August, 1897, to April, 1898).

The maps of so-called Biological Specific Intensity were prepared by a simple method, which while missing absolute verity, led to results consistent with the exact truth. The shading was laid on the map in a succession of equal tones *as often over the same area as there were recorded observations of different species hav-*

ing been met or taken there. In this way the regions occupied by the greater number of species became progressively deeper and deeper colored, while those with a less number remained, in exact relative proportion, lighter. The invaluable record of Dr. Pilsbry was taken as a determinative guide.

I am deeply indebted to the kindness of Dr. H. A. Pilsbry for suggestions, notes, and advice. His patience in reading the MS. and his genial and consistent helpfulness cannot be too gratefully acknowledged by the writer.

PULMONATA GEOPHILA.

A. MONOTREMATA.

AGNATHA.

FAMILY TESTACELLIDÆ.

Glandina vanuxemensis *Lea.*

Cat. No. 1. Figured specimen, T. M., Vol. III, pl. lxii, fig. 1.
One specimen, locality unknown.

This specimen belonged to the original Amos Binney collection. It is slightly longer than the colored drawing in T. M., and differs now sensibly in color from that figure. It is a pale rufescent straw color with indistinct traces of green at the transparent lower edges. The outer lip, drawn entire, is now irregularly broken, and has lost some 5 mm. of its outer border. The longitudinal lines referred to in the original description — "surface coarsely granulated by the decussation of longitudinal and revolving lines" — are resolved in the upper half of the whorls into a series of narrowly elongated low beads which are sometimes confluent across the revolving lines but more frequently limited by them.

Glandina truncata (*Gmelin*).

Cat. No. 2. Fig. spec., T. M., Vol. IV, pl. lxxx, fig. 9.

Cat. Nos. 2–15.

Alabama, 2.	**Georgia,** St. Simons Island, 13.
Florida, 6 ; Captive Island, 1.	**South Carolina,** Charleston, 6.

The collection does not contain the original specimens figured in T. M., pl. lix, lx. The chatoyant rosiness of the specimen figured by W. G. Binney has almost disappeared, and his figure hardly expresses the slight tumidity below the suture, nor the corded effect — "delicately fluted" — of the shining longitudinal channeled striæ. Mr. Binney remarks of this specimen that it is "one of the most singular varieties of this variable species." The varietal range of the species might be safely defined as lying between an elongated and a globose form. One vial holds a *Polygyra* taken from the stomach of one of the specimens.

Glandina truncata, var. **minor** *Binney*, MS.

Cat. No. 16. Type of *texasiana*, var. W. G. B., T. M., Vol. IV, pl. lxxvii, fig. 21.

Three specimens, from Florida.

The two specimens received from Mr. Binney and placed with this form are more globose, the type specimen bearing a deceptive resemblance to *G. parallela* W. G. B., as limited by him (Proc. Acad. Nat. Sci. Phila., 1857), and now referred to *truncata*. The outer lip of this specimen is broken and the peculiar bluish fuliginosity, as figured, is faded. Var. *minor* is a collection term used by Dr. Binney and not in print. It is alluded to in T. M., Vol. IV, p. 141, "this well characterized species was considered as a variety of *Glandina truncata* by Binney."

Glandina truncata, var. *Binney.*

Cat. No. 17. Fig. spec., T. M., Vol. III, pl. lxi, fig. 2.

One specimen, from Key West, Florida.

This variety was regarded by W. G. Binney as a "well characterized species," and placed under *G. texasiana* Pfeiff., but later (Manual Amer. Land Shells) referred back as a variety of *truncata*. This specimen is well preserved, still retaining the yellow and pale amethystine coloring of the figure.

Glandina truncata, var. *W. G. Binney.*

Cat. No. 18. Outline figure, T. M., Vol. III, pl. lxii, fig. 2.

A specimen from Louisiana.

This variety was made the species *G. parallela* by W. G. Binney, "distinguished by its peculiar parallel sides and heavy texture," "with a heavy callus." These features certainly fail to distinguish this species from No. 2, and Mr. Binney has referred it to *truncata.*

References: W. G. Binney, Proc. Acad. Nat. Sci. Phila., 1857, 189; T. M., Vol. IV, 140; L. S. N. A., I, 17; Tryon, Am. Journ. Conch., II, 226.

Glandina decussata (*Desh.*).

Cat. No. 20. Fig. spec., T. M., Vol. III, pl. lxi, fig. 1.

Cat. Nos. 19, 20. Three specimens, from Texas.

The figured specimen in T. M. was referred by Gould to *truncata*, and later (Proc. Acad. Nat. Sci. Phila., 1857, 189; T. M., IV, 139) by W. G. Binney made into "the most distinctly marked species of the genus found in America," *G. corneola*, from which specific position it was displaced by Deshayes and transferred to *Achatina decussata*, under which species Mr. Binney later placed it. In the other two specimens (No. 19) referred by Mr. Binney to this species the decussate surface is barely distinguishable. In the figured specimen the crisped surface suggests a microscopic reduction of that of *vanuxemensis.* Deshayes's figures (Pl. cxxxiv, figs. 33–35) of his *Agathine treillissée* are very good, but his description hardly separates it from *carmenensis.*

Glandina bullata *Gould.*

Cat. Nos. 21, 22. Three specimens, from New Orleans, Louisiana.

Certainly not distinguishable from the short globate and suppressedly striate examples of *G. truncata.*

Glandina texasiana (*Pfeiff.*).

Cat. No. 23. One specimen, from Texas.

Mr. Binney says he "erroneously referred to this species the small form of *G. truncata*" (see above); on comparing the specimens in the collection the denticulate suture and low and finer striæ seem to form distinguishing features.

HOLOGNATHA.

FAMILY SELENITIDÆ.

Macrocyclis vancouverensis (*Lea*).

Cat. No. 24. Fig. spec. T. M., Vol. III, pl. xx (as *Helix*).

Cat. Nos. 24–39.

California, 3; Oakland, 3; San Francisco, 6.

Montana, Cœur d'Alene Mts., 2.

Oregon, Astoria, 5; near Dalles, 3; Lake Klamath, 5; Portland, 2; Willamette Valley, 2.

Washington, Kalama, 4; Columbia River, 3.

The collectors of these specimens have been the U. S. Exploring Expedition, H. Hemphill and Rev. Jos. Rowell. A very interesting specimen, apparently labeled in the handwriting of Mr. Bland, from Astoria, Oregon, affords a transition form to *sportella*. It is named on the collection labels var. *semi-decussata*, and shows on the inner whorls, with obsolete indications on the last, the revolving lines that, in crossing the "incremental striæ," sculpture the surface of *sportella*. Dr. Pilsbry suggests that it should not be accorded position and is probably var. *hybrida* Ancey.

Macrocyclis sportella (*Gould*).

Cat. No. 41 (?). Fig. spec., L. S. N. A., pt. 1, p. 57, fig. 97.

Cat. Nos. 40–42.

California, Contra Costa Co., 1.

Washington, Tenino, 2.

A feature of differentiation from *vancouverensis*, not mentioned in published descriptions, is the formal structure of the lines of growth, "incremental striæ." They are regularly spaced and of uniform height.

Macrocyclis concava *Say*.

Cat. Nos. 43–65.

Alabama, 2.
Canada, Pt. Levi, 1.
District Columbia, 2.
Georgia, 1.
Illinois, 2.
Indiana, 2.
Iowa, 1.
Kentucky, Henry Co., 3.
Michigan, Kalamazoo, 1.
Mississippi, Vicksburg, 2; Natchez Bluff, 3.
New York, Westport, 1; Greenwich, 3; Utica, 4.
Ohio, 6; Circleville, 2.
Pennsylvania, Schuylkill, 1; Montgomery Co., 1; Broad Top Mt., 5; Canonsburgh, 2.
South Carolina, Cooper River, 1.
Tennessee, Monroe Co., 3.
Virginia, Fairfax Co., 1.

Three specimens are marked var. *minor*. The distinction seems hardly founded in nature. They are impoverished or starved individuals.

Macrocyclis voyana *Newc.*

Cat. No. 66 (?). Fig. spec., T. M., Vol. V, p. 93, fig. 12.

Cat. Nos. 66–69.

California, 3 ; Alameda Co., 2 ; San Diego, 3.

Macrocyclis duranti (*Newc.*).

Cat. No. 70. Fig. spec., T. M., Vol. V, p. 94, fig. 13.

The specimens in the collection (Nos. 70–72) come from Catalina Is., Santa Barbara Is., and San Diego, Cal.

A MS. label expresses the opinion that this species is only the young of *M. voyana*. The ascertained young of *voyana* certainly approach it closely.

Macrocyclis hemphilli *W. G. B.*

Cat. No. 73. Two specimens, imperfect, from Olympia, Washington, collected by Mr. H. Hemphill in 1878.

At first glance the observer would be inclined to place this species under *vancouverensis*, as a variety, but comparison indicates Mr. Binney's good judgment in separating it, on account of the glassy texture, absence of all revolving lines, and the burnished umbilicus.

FAMILY LIMACIDÆ.

Zonites (Mesomphix) capnodes *W. G. B.*

Cat. No. 74. Type, T. M., Vol. IV, pl. lxxx, fig. 14; Vol. V, p. 98, fig. 19.

Cat. Nos. 74–79.

Alabama, 5 ; Uniontown, 2. **Arkansas,** 3. **Tennessee,** 2 ; Knoxville, 2.

Zonites (Mesomphix) fuliginosus (*Griff.*).

Cat. No. 81. Fig. spec. (?), T. M., Vol. III, pl. xxxi, fig. 1.

Cat. Nos. 81–89.

Florida, 4.
Ohio, Hamilton Co., 3.
New York, Utica, 2.
Tennessee, 6.
South Carolina, Aiken, 2.

The original (?) A. Binney specimens are without locality. There is a reversed and a sub-fossil specimen. An interesting feature in the distribution of this species is mentioned by Dr. Call (Mollusca of Indiana), namely, its scarcity at Lawrenceburg, Indiana, and its frequency opposite that town on the south side of the Ohio River in Kentucky. Its metropolis seems to be Tennessee. In Mr. Pilsbry's paper on the 'Mollusca of the Great Smoky Mountains,' the boundary region of Tennessee and North Carolina, *Z. fuliginosa* var. *polita* Pils. is given as replacing the ordinary *fuliginosa* in those mountains.

Zonites (Mesomphix) friabilis (*W. G. B.*).

Cat. No. 93. Type, T. M., Vol. IV, pl. lxxx, fig. 2.
Fig. spec., T. M., Vol. V, p. 101, fig. 21.

Cat. Nos. 90–101.

Kentucky, Lawrence Co., 1; Trimble Co., 3.
Illinois, 1; Athens, 2; Wabash, 1.
Indiana, Madison, 6.
Louisiana, Brashear Co., 5.
Tennessee, 4.
Texas, Washington Co., 3 adult and 5 young.

The original specimen is from Wabash, Ill. Dr. Call (Mollusca of Indiana) remarks that he has "never found this species in Indiana," and enters it on the authority of Mr. Binney. The specimens from Indiana (Cat. No. 94) are quite unmistakably *friabilis*, and the initials A. G. W. on the locality label indicate Mr. Wetherby, of established fame as a collector, as the authority.

Zonites (Mesomphix) caducus (*Pfeiff.*).

Cat. No. 102. Fig. spec. (?), T. M., Vol. V, p. 102, fig. 22.

One specimen from Mexico possesses a well expressed insulation, but its identity with Say's *lucubrata* has been questioned by Mr. Binney himself, and Say's description, excepting "much wrinkled," fits it well enough. The oblateness of the last whorl and horny consistency are distinguishing features. The Mexican specimens in the Haines and Crooke sections of the Museum collection are, however, in some examples, strongly banded with color zones on the periphery of the volutions, which appear as a rufous ribbon at the suture.

Zonites (Mesomphix) lævigatus (*Pfeiff.*).

Cat. No. 104. Fig. spec., T. M., Vol. V, p. 103, fig. 24.

Cat. Nos. 103–123.

Alabama, Baldwin Co., 2.
Arkansas, Helena, 2.
Florida, St. Augustine, 3; Steinhatchie River, 2.
Georgia, Columbus, 3.
Illinois, 2.
Indiana, 2.
Kentucky, op. Cincinnati, 3; Milton, Henry Co., 2; Henry Co., 1.
North Carolina, Cherokee Co., 1; Charlotte, 2.
Tennessee, Lookout Mt., 6; Chilihowee, Val., 1; Eastern Tennessee, 3.
Texas, Orange, 1.

This species is not mentioned in Call's 'Mollusca of Indiana' though it occurs at Lawrenceburg, in that State. An examination for Pilsbry's recent (1900) varieties *perlævis* and *latior* failed to detect them.

Zonites cultellatus (*Thomson*).

Cat. No. 124. Type, T. M., Vol. IV, pl. lxxvi, fig. 6. See also Proc. Acad. Nat. Sci. Phila., IX, p. 185, 57; Notes, p. 5.

The single specimen of this problematic species is from Contra Costa County, California, and, as originally suggested by Binney, is a form of *Zonites acies* Partsch. It is far less carinate, and the tabulation in the sutures is much less exsert, but the shell in all respects closely resembles *acies* with a derivative resemblance to *albanicus* Ziegl. or *compressus* Ziegl. In his 'Manual of American Land Shells' Mr. Binney excluded this from his list, as it seemed extralimital or European. Since then both Dr. Cooper and its author Mr. Thompson have alluded to its suspicious nature (Bull. Cal. Acad. Sci. IV, p. 246; Proc. Cal. Acad. Sci., series 2, I, p. 11, 1887). Mr. Thompson is apparently inclined to regard it as *Arionta mormonum* var. *circumcarinata* Stearns, a view apparently prompted by Dr. Newcomb. This is utterly unsustained by comparison, and Binney's suggestion yet remains the most intelligible explanation of the occurrence of this beautiful and distinctive shell.

Zonites (Mesomphix) rugeli (*Shuttl.*).

Cat. No. 125. Two specimens from Roan Mountain, N. C., collected by Mrs. G. Andrews.

In both examples the peristome is sensibly darkened, and the intermittent growth of the shell is thus indicated by successional bands of deeper color.

Zonites (Gastrodonta) demissus (*Binney*).

Cat. No. 126. Type, Boston Journ. Nat. Hist., Vol. IV, pl. xvi, fig. 16. T. M., pl. xlii, fig. 1.

Cat. Nos. 126–138.

Alabama, Marengo Co., 5.
Arkansas, Hot Springs, 5.
Florida, Cedar Keys, 1.
North Carolina, Cherokee Co., 1; Goldsboro, 1; Clay Co., 2.
Pennsylvania, Cambria Co., 1.
Tennessee, Union Co., 2; Roane Co., 2.

Var. *acerra* Lewis.

Texas, 2.

The variety *acerra* Lewis according to Dr. Pilsbry's recent observations (Proc. Acad. Nat. Sci. Phila., 1900, p. 142) is "commonly distributed in the Smokies," attaining an altitude of 6,500 feet. The conditions operative in forming a species seem to have force in the case of this variety, but it also would seem a just tribute to nature to say she can make the same thing large and small, *acerra* being a recognition of her enlarging propensities.

Zonites (Gastrodonta) ligerus (*Say*).

Cat. Nos. 139–150.

Indiana, 3; New Harmony, 1.
Kentucky, Whitley Co., 1; opp. Cairo, 10.
New Jersey, Red Bank, 1.
Ohio, Hamilton Co., 6; Cincinnati, 12.
West Virginia, Big Sandy, Wayne Co., 6.

A very high, as Dr. Pilsbry might express it, "bee hive" form from Indiana is conspicuous, and is marked by Binney as "abnormal." Following the prevalent hunt for varieties "*sagdinoides*" might be suggested as a soubriquet. As a matter of archæological interest, amongst these specimens is the *H. wardiana* Lea, with Dr. Ward's label. It was of this specimen that Gould remarks, it "is undoubtedly the young of this (*H. ligera*) species. The distinction in the animal, noticed by Dr. Ward, was afterwards ascertained by him to be merely accidental."

Zonites (Gastrodonta) intertextus (*Binney*).

Cat. No. 151. Outline figure, T. M., pl. xxxv, *ad dextram.*

Cat. Nos. 151–165.

Georgia, 4.
Indiana, 1.
Kentucky, 3.
Mississippi, Natchez, 1 (fossil).
New York, Mohawk, 6; Niagara, 1.
Ohio, 4; Adams Co., 5; Columbus, 3.
South Carolina, Aiken, 3.
Tennessee, Monroe Co., 2.
Texas, 1.
Virginia, Alleghanies, 5.

As Dr. Call has questioned the specific separation of *intertextus* from *ligerus*, and as Dr. Binney acknowledges his prolonged uncertainty as to its specific value, the result of comparing these suites of authentic specimens may be of interest.

It forms perhaps a convenient signal for the detection of specific *separateness* if we examine in a long suite of specimens the leading varietal tendency, and where in two approximate species one exhibits a predominant variation not shown in the other the original specific separation is justified. This might be called the *law of specific anomaly.*

In looking over *intertextus* a well marked tendency in form growth, not observable in *ligerus*, is seen in the compression of the spire with the consequent carination of the outer whorl. Traces of this in large and rotund specimens seem apparent in the slight peripheral angulation emphasized by the "whitish narrow band" mentioned in descriptions. The revolving lines cutting the striæ are also seen in some specimens, though generally it requires an enlightened imagination to detect them.

Zonites (Mesomphix) subplanus (*Binney*).

Cat. No. 166. Type, T. M., Vol. III, pl. xxxiii.

Cat. Nos. 166, 167.

The single specimen with a locality is from the Smoky Mountains, N. C. Dr. Pilsbry gives the diameter of two large individuals as $23\frac{1}{3}$ and $21\frac{1}{2}$ mm., respectively; the larger of Binney's two examples is 20.63 mm.

Zonites (Mesomphix) inornatus (*Say*).

Cat. No. 169. Fig. spec., T. M., Vol. III, pl. xxxiv.

Cat. Nos. 168–183.

Georgia, 2.

Kentucky, opp. Cincinnati, 2; Pine Mt., Cumberland Gap, 1; Lawrence Co., 2; Laurel and Whitley Cos., 4.

Maryland, 4.

Massachusetts, Berkshire Co., 2.

New York, Greenwich, 5.

Ohio, 2.

Pennsylvania, Lycoming Co., 1; Elk Co., 2; Cambria Co., 2; Huntingdon Co., 1; Warren, 1.

Virginia, 1.

The specimen indicated can only be doubtfully referred to the figure given in Gould's Binney (T. M.), being somewhat smaller than the figure. The specimen referred to by Mr. Binney (Manual of Amer. Land Shells, p. 218) as having "three well-developed, sharp, tooth-like processes on the internal thickened margin of the peristome" is in this collection.

Zonites (Hyalina) sculptilis (*Bland*).

Cat. Nos. 184, 185. Two specimens, one from Philadelphia, and one from mouth of Laurel River, Whitley Co., Ky.

Dr. Pilsbry remarks that "under a strong lens the surface of this species is seen to be granulose in spiral series"; Bland's specimens (type not found) do not show this feature.

Zonites elliotti (*Redfield*).

Cat. No. 186. Fig. spec., T. M., Vol. III, pl. lxxvii, fig. 18.

Cat. Nos. 186–188. Three specimens from East Tennessee, and three from Hayesville, N. C.

Zonites (Gastrodonta) cerinoideus (*Anth.*).

Cat. No. 189. One specimen from Charleston Co., S. C.

Zonites (Hyalina) cellarius (*Müll.*).

Cat. Nos. 190–193.

England, 4.

Italy, 2; Como, 2.

Massachusetts, Boston, 1.

Sweden, 1.

This globe-trotting species was announced in 1888 (Proc. Cal. Acad. Sci.) from San Francisco by Dr. Cooper, to whom Mr. W.

Sutton reported them as "numerous in a garden near the center of San Francisco," the locality producing large (.55 inch in width) specimens.

This snail was introduced, through commerce, into the United States, about fifty years ago, and maintains itself in sea-board towns or cities, living in cellars along the Atlantic coast.

Zonites (Hyalina) whitneyi (*Newc.*).

Cat. No. 194. Two specimens from Lake Tahoe, Nevada.

Zonites (Hyalina) nitidus (*Müll.*).

Cat. No. 195. Fig. spec., L. S. N. A., p. 32, fig. 35.

Cat. Nos. 195–200.

Germany, 4.
Michigan, Grand Rapids, 6.
New York, Hamilton, Madison Co., 2.
Ohio, 17 ; Columbus, 6.

Zonites (Hyalina) arboreus (*Say*).

Cat. Nos. 201–231.

Canada, Great Slave Lake, 3 ; Pembina, 12 ; River Rouge, 2 ; Bevins Lake, 1.
Guadeloupe, 5.
Cuba, 6.
British America (?), 11.
Alabama, 4.
Arkansas, 5.
California, Los Angeles, 4 ; San Diego Co., 5 ; Emigrant Gap (5000 ft.), 5 ; Lake Tahoe, 2 ; Indian Valley, 1.
District Columbia, 2.
Florida, Sarasota Bay, 6 ; St. Augustine, 4.
Kansas, 4.
Maine, Orono, 9 ; Fairfield, 9.
New Jersey, Squam, 6.
New Mexico, 20.
New York, Greenwich, 13 ; Herkimer Co., 10.
Minnesota, 1.
Ohio, Columbus, 15.
Oregon, Salem, 8.
South Carolina, Cooper River, 3.
Utah, 3.

Dr. Pilsbry remarks (Mollusca of the Great Smoky Mts.) that " it seems to occur throughout the mountains, though far more sparingly than on lower country, and apparently varies from the northern shells in being somewhat smaller and frequently more widely umbilicated." Variations in the specimens so widely distributed as shown in the foregoing list are noticeable, but the impression left, after looking them over, is, that their specific uniformity is remarkable.

Zonites (Hyalina) viridulus (*Menke*).

Cat. Nos. 232–245.

Europe, 2.
Great Britain, 3,
Canada, Great Slave Lake, 2.
Georgia, 20.
Indiana, Lawrenceburg, 15.
Maine, Orono, 18.
New Mexico, Ft. Defiance, 2.
New York, Mohawk Valley, 7; Greenwich, 10.
Ohio, Columbus, 30; N. Philadelphia, 8.
Oregon, Portland, 7.
Texas, Bosque Co., 1.
Utah, 1.

Dr. Call does not record this species for Indiana. The fifteen specimens were taken by Mr. Wetherby, and are clean and beautiful examples.

Zonites (Hyalina) indentatus (*Say*).

Cat. Nos. 246–258.

Canada, Miseisquvi, 3.
District Columbia, 2.
Georgia, 4.
New Jersey, Sussex Co., 2.
New York, Greenwich, 3; Ulster Co., 1.
Ohio, Circleville, 20; Columbus, 12.
Tennessee, 5.
Texas, 6.
Utah, 1; Emigrant Cañon, 3.

It is difficult to resist the inclination to place this attractive little form with *sculptilis*, which it closely resembles.

Zonites (Hyalina) petrophilus *Bland.*

Cat. No. 259. Of this beautiful little species the collection contains four of the original lot from Knoxville, Tenn.

Dr. Pilsbry says it "is not known to occur in the Great Smoky Mountains," the form reported from that section being Dr. Pilsbry's recently described variety *pentadelphia.*

Zonites (Hyalina) wheatleyi *Bland.*

Cat. No. 260. Six specimens from the original locality, "The Cliffs" (on the southern bank of the Tennessee River), Knoxville, Tenn., taken by Mrs. G. Andrews.

Zonites (Hyalina) limatulus *Ward.*

Cat. Nos. 261–263. Lawrenceburg, Ind.; Columbus, Ohio; and San Mateo, Cal.; numerous specimens.

The single specimen from California appears to be safely *limatulus;* the flat spire and wide umbilicus appear to be infallible marks of separation from *arboreus.*

Zonites (Hyalina) minusculus (*Binney*).

Cat. Nos. 265–277.

Cuba, 15.
California, Los Angeles, 5.
District Columbia, Washington, 1.
Georgia, 6; St. Simons Is., 15.
Michigan, 4.
Ohio, 2; Columbus, 4.
South Carolina, Sullivans Is., 6.
Texas, 3; Wash'n Co., 4.
Without locality, 40.

Zonites (Hyalina) milium (*Morse*).

Cat. Nos. 278–281.

California, Lone Mt., 2. **Maine,** Orono, 14. **Ohio,** 7.

Zonites (Hyalina) binneyanus (*Morse*).

Cat. Nos. 282–283. Type specimens (?), from Orono, Maine.

Zonites (Hyalina) ferreus *Morse.*

Cat. No. 284. Four, from Orono, Maine.

Zonites (Hyalina) conspectus *Bland.*

Cat. Nos. 285–287.

Alaska, 4. **California,** San Francisco, 14. **Oregon,** Astoria, 4.

Zonites (Hyalina) exiguus (*Stimp.*).

Cat. No. 288. Type, T. M., Vol. III, pl. lxxxvii, fig. 19.

Cat. Nos. 288, 289. Fifteen specimens, from the original locality, Orono, Maine.

The beautiful surface sculpture of this elegant species is fully revealed by a pocket lens of ½ inch focal length.

Zonites (Hyalina) chersinellus (*Dall*).

Cat. No. 290. Type, L. S. N. A., p. 43, fig. 67.
Cat. Nos. 290, 291. **California,** Calaveras Co., 3.

The type specimen is marked as from Big Trees, California, and another specimen from Calaveras Co., Cal., is identical in character. The enlarged figure in the 'Manual of American Land Shells' is the only adequate representation of this interesting species, and is a facsimile of Dall's figure published in the Amer. Jour. Conch., Vol. II, pl. xxi, fig. 4.

Zonites (Hyalina) capsella (*Gld.*).

Cat. No. 292. Type (?), T. M., Vol. III, pl. xxix, fig. 1.
Cat. Nos. 292, 293. From Tennessee, and Lexington, W. Va.

Zonites (Hyalina) placentula *Shuttl.*

Cat. No. 294. Fig. spec., T. M., Vol. V, p. 124, fig. 44.

Cat. Nos. 294–296. Four specimens, from Monroe Co., Tenn., and St. Giles Co., Va.

This species, first united with *capsella* by Binney and afterwards separated, is now regarded by Pilsbry as a variety of *capsella*. In the collection the large size of *placentula*, the more robust last whorl and spreading umbilicus would, without a wider range of comparison, serve as distinctions.

Zonites (Hyalina) alliarius (*Müll.*).

Cat. Nos. 297–301.

Of this species, common in many districts in England—where the variety *viridulus* (not Menke) has also been noted—there are eleven specimens taken in the United States; one from New Jersey, three from Brooklyn, N. Y., one from Richmond, Ind., and six from Chicago. The species resembles *cellarius*. The specimen from Indiana was received from Dr. Call, though in his recent 'Mollusca of Indiana' it is not recorded. There are also three specimens from England.

Zonites (Conulus) upsoni *Calkins.*

Cat. No. 302. Eight specimens, from Rockford, Illinois.

Subsequently referred by Binney to *Vertigo ovata*, in a half-grown stage, a decision which seems to be correct.

Zonites (Conulus) fulvus (*Drap.*).

Cat. No. 303. Fig. spec., L. S. N. A., p. 46, fig. 73.

Cat. Nos. 303–330.

Canada, Red River of the North, 1; Great Slave Lake, 2; Lake St. John, 1.

Siberia, Petropaulus, 4.

Alabama, 4; Perry Co., 11.

California, Lake Tahoe, 3.

District Columbia, 2.

Florida, St. Augustine, 1.

Maine, Orono, 50.

Michigan, Ann Arbor, 2.

Nebraska, 1.

Nevada, White Pine, 16.

New York, Buffalo, 30; Greenwich, 4; Staten Island, 4.

Ohio, Cincinnati, 10; var. *dentatus* Sterki, 2; Columbus, 3.

Oregon, Portland, 5.

South Carolina, Cooper River, 1.

Texas, Washington Co., 2; Bosque Co., Mategorda, 2.

Utah, Salt Lake (altitude 4500 ft.), 3.

There are also a few specimens from England and Savoy.

The above records are for *fulvus* in the former broad acceptance of the species, which is now subdivided into several species and varieties (Nautilus, XII, p. 113). The elevated and depressed forms are represented. Apparently the elevated forms are to be classed as *chersinus* Say.

Zonites (Conulus) gundlachi (*Pfeiff.*).

Cat. No. 331. Fig. spec., L. S. N. A., p. 48, fig. 77.
Five specimens, from Florida.

Zonites (Conulus) stearnsi (*Bland*).

Cat. No. 333. One specimen, from Portland, Oregon.

Zonites (Gastrodonta) gularis (*Say*).

Cat. Nos. 334–356.

Alabama, 5; Decatur, 4; Perry Co., 2.

Georgia, 9; Franklin Co., 3; Columbus, 1.

Kentucky, Whitley Co., 6 +; Henry Co., 4.

Pennsylvania, Alleghanies, 2.

Tennessee, 28 +; Union Co., 4; Philadelphia, 2.

Virginia, 3; Lexington, 3.

Without locality, 7.

Dr. Pilsbry has examined a great number of specimens of this species, and remarks of it, that "the same sort of shell prevails throughout most of the localities thus far explored in the Great Smokies."

A group from Decatur, Ala., which Mr. Bland marked in his cabinet as *nov. sp.* are apparently young, but they are quite imperforate. A superb specimen from Kentucky, marked *major*, is five eighths of an inch (15.87 mm.) in height.

Zonites (Gastrodonta) cuspidatus *Lewis.*

Cat. No. 357. Four specimens, with wide umbilicus, from Tennessee.

Zonites (Gastrodonta) suppressus (*Say*).

Cat. Nos. 358–367.

Florida, Cowford, 1.
Michigan, 1.
New York, Staten Island, 2.
Ohio, 11; Summit, 2.
Pennsylvania, Columbia, 2.
South Carolina, Charleston, 14.
Tennessee, 1.
Virginia, Buffalo Co., 7 miles from Lexington, 4.

Certainly very close to *gularis.*

Zonites (Gastrodonta) lasmodon (*Phillips*).

Cat. Nos. 368–371. Specimens from Alabama, Georgia, and Tennessee.

Zonites (Gastrodonta) macilentus (*Shuttl.*).

Cat. No. 372. One specimen, Knoxville, Tenn.

Zonites (Gastrodonta) significans (*Bland*).

Cat. No. 373. Three specimens, Union Co., Tenn.

Zonites (Gastrodonta) andrewsi *W. G. Binney.*

Cat. No. 374. One specimen, Roan Mt., N. C.

Zonites (Gastrodonta) internus (*Say*).

Cat. Nos. 375–379. **Tennessee**, Chattanooga, 8; University Place, 1; Lookout Mt., 10.

The *stephanophora* Desh., from Madeira, approaches unpleasantly near *internus*, and if taken in a neighboring district would be regarded as varietal. The lower surfaces of the two species differ; a greater rotundity, and absence of the umbilical deflection differentiates in superficial features *stephanophora* from *internus.*

Zonites (Gastrodonta) multidentatus (*Binney*).

Cat. Nos. 381–382. Twelve, from Ohio.

Vitrinizonites latissimus (*Lewis*).

Cat. Nos. 383–385. One specimen from Thunder Head in the Great Smoky Mountain Range, one from Bald Mountain, East Tennessee, animal from Roan Mountain, N. C.

Dr. Pilsbry says (Mollusca of the Great Smoky Mts.) "the species is ubiquitous in the Great Smokies everywhere above 2000 feet, though not found in great numbers, and restricted to moist places where moss carpets the rocks or logs. These conditions are met on the lower levels where the mountain slopes are densely shaded, but on the cloud-touched heights not much shade is necessary."

Vitrina limpida *Gld.*

Cat. Nos. 386–390.

Canada, Red River of the North, 1. **Maine,** Orono, 11. **New York,** 14.

Vitrina angelicæ *Beck.*

Cat. No. 391. One specimen, from Godhavn, Greenland.

Mörch remarks (Amer. Jour. of Conch.) that "the land shells of Greenland are nearly allied to those of Iceland. The *Vitrina*, the *Succinea*, and *Hyalina alliaria*, accord better with the species of Iceland than with American species."

Vitrina pfeifferi *Newc.*

Cat. No. 392. Fig. spec., T. M., Vol. V, p. 138, fig. 53; L. S. N. A., p. 27, fig. 23.

Cat. Nos. 392–395.

Colorado, 2. **Nevada,** White Pine, 5. **Utah,** Logan Cañon, 5000 feet.

Vitrina exilis *Morelet.*

Cat. No. 396. One specimen from Petropaulavski, Kamtschatka.

A membranous shell, slightly striate, peristome flaccid, impressed suture, and decrescent spire.

Limax maximus *Linn.*

Cat. No. 397. Internal plate, Newport, R. I., 1.

Limax agrestis *Linn.*

Cat. Nos. 399, 400. Internal plates.

Massachusetts, Cambridgeport, 1. **New York,** Brooklyn, 1.

Mr. G. W. Taylor (Nautilus, Vol. V, p. 92) notices the presence of this slug in Vancouver Island.

He says, "I believe that I first observed this slug about seven years ago in the Victoria gardens, and it has since developed into a dreadful pest. There cannot be, I think, any doubt as to the species being an introduced one, as it has not yet been noticed in any part of Vancouver Island other than in Victoria, and the specimens resemble British ones in every respect save that the milky slime is not nearly so copious."

Limax campestris *Binney.*

Cat. No. 401. Internal plate, 1.

FAMILY HELICIDÆ.

Helix (Patula) solitaria *Say.*

Cat. Nos. 404–414.

Idaho, Cœur d'Alene Mts., 3; near Mission, 3.

Indiana, Madison, 2 (1 fossil); New Harmony, 2.

Kentucky, Henry Co., 2; Drennan Hills, Henry Co., 5.

Ohio, 9; Strontian Is., Lake Erie, 2.

The fossil specimen is larger than the living examples, more robust, and with a thickened peristome. It still retains the brown revolving bands. This shell occurs in western Pennsylvania (Indiana and Allegheny Counties), as noted by E. H. Harn and S. H. Stupakoff. Bryant Walker remarks, "an inhabitant of the southern portion of Michigan; very rare in the southeastern part, where in some localities it is extinct; more common in the western."

Helix (Patula) strigosa *Gld.*

Cat. No. 415.	Fig. spec., T. M., vol. III, pl. xxvi*a*
Cat. No. 416.	T. M., vol. V, p. 158, fig. 64.
Cat. No. 458.	T. M., vol. IV, pl. lxxvii, fig. 11.

Cat. Nos. 415–483.

Colorado, 17 ; Manitou, Williams Cañon, 1 ; Headwaters of Colorado River, 2 ; Grand Cañon, Arkansas River, 3, and 12 young ; Deer Creek Cañon, 26.

South Dakota, Black Hills, 5.

Idaho, 3 ; near Franklin (5000 ft.), 2 ; Salmon River, 13 ; White Bird, 2.

Nebraska, 1.

Oregon, 1 ; Eastern Cos., 5.

Utah, Box Elder Co. (5000 ft.), 39 ; Logan Cañon (5000 ft.), 2 ; Oquirrh Mts. (4300 ft.), 4 ; near Salt Lake City (4500 ft.), 14 ; Summit Cañon, 2; Wasatch Range, 14; Weber Cañon, 10.

Washington, Bitter Root River (4000 ft.), 5 ; Bitter Root Mts. (2200–6600 ft.), 3.

New Mexico, Rio Piedro, 4.

Wyoming, Wind River Mts., 5 ; Bridger Pass, 1 ; Big Horn Mts., 11.

Without locality,20.

Dr. Binney's observation that "the species varies greatly in shape" is certainly a just tribute to the protean character of this shell. Many of the specimens have been collected by Mr. Hemphill, who has so much enlarged the varietal nomenclature of the species. The variations present six phases of form growth,—flattening of the shell with or without carination ; thickening and elevation of the incremental striæ ; deflection of the last whorl at the aperture ; development of evenly spaced revolving ribs ; presence of a callus "yoking" the apertural limits ; and texture of the shell. There is also diversity in the width, depth of coloration, and absence of the color bands. Dr. Binney has indicated the "distinct specific characteristics" of the genitalia of *P. strigosa* and *P. solitaria;* in some instances of well-rounded examples of the former, the shell would hardly establish a clear separation from the latter. In alluding to the character of the interblending varieties of this species, Mr. Hemphill remarks : "Taken as a whole, this series of shells as now completed, seems to me to offer the best guide or key to the study of species that the student can have. Every known external character belonging to the genus *Helix* is so gradually modified and blended with opposite characters, that if one had the molding or making of the many and various intermediate forms, he could scarcely make the series more complete than Nature has done herself."

Helix (Patula) hemphilli *Newc.*

Cat. Nos. 484–490. Five specimens from White Pine Creek, Nevada, at elevations of 5000 and 8000 feet ; two from the Oquirrh Mts., Utah, at an elevation of 4300 feet.

Dr. Binney retains "a distinct specific name for *hemphilli* on account of the presence of side cusps and cutting points to the central and lateral teeth on its lingual membrane; otherwise the shell would be considered a variety of *strigosa*." As far as the shells subserve the ends of classification, *hemphilli* seems a not very advanced variety of *strigosa*. There is in the last whorl a noticeable tendency to a deflection of the lip.

Helix (Patula) idahoensis *Newc.*

Cat. Nos. 491–509.

Idaho, Salmon River, 2; Salmon River Mts. (1500 ft.), 2. **Utah,** Bear River, 2; Box Elder Cr. (4500 ft.), 32; near Ogden (4500 ft.), 3.

Variations in the coarseness and elevation of the radiating ribs, absence or presence of color bands, development of callus at mouth, carination — in *wasatchensis* H. becoming an explanate collar or beaded line in the suture — and height of shell are variable features.

It is an adequate commentary on the foregoing group of interblending species to quote Mr. Simpson's observation that "in the wonderful series of *Patula*, beginning with elevated shells with rounded whorls and strong radiating ribs known as *Helix idahoensis*, which varies gradually through the less elevated and smoother forms of *cooperi* and *strigosa* to *hemphilli* and *haydeni*, which are lenticular and sharply keeled with strong revolving sculpture, we find such irregular varieties or natural hybrids, which hardly admit of naming. Elevated forms are not rare, having radiating sculpture and sharp keels, in others of the same general form the ridges are revolving, thus partaking more or less of the characters of *idahoensis* and *hemphilli*; and greatly flattened shells are met with, without keels and with more or less decussated or even radiating sculpture,—in fact, in the 1500 or more specimens of this protean form in the collection of the National Museum one can observe this crossing of characters in almost every direction. To attempt to designate these hybrids, if such they are, by name is simply an impossibility."

Helix (Patula) alternata *Say.*

Cat. No. 558. Fig. spec., L. S. N. A., p. 75, fig. 126.

Cat. Nos. 510–569.

Arkansas, 4.

Alabama, 10.

Georgia, Franklin Co., 2.

Illinois, 7.

Indiana, 5.

Iowa, 2.

Kentucky, Lawrence Co., 2.

Massachusetts, Berkshire Co., 1; Marblehead, 5; House Is., Manchester, 6.

Michigan, 3; Sault Ste. Marie, 2; Beauford Is., Lake Huron, 1.

Maine, Broken Cave Is., Casco Bay, 1.

Minnesota, St. Paul, 3; Sources of Mississippi River, 1.

Missouri, 3; St. Louis, 2.

Nebraska, 3.

New Hampshire, 3.

New Jersey, 3.

New York, Westport, Lake Champlain, 3; Saint Island, 3; Utica, 4.

Ohio, 3; Strontian Is., 3.

Pennsylvania, Alleghanies, 2; Canonsburg, 2; Wissahickon, 1.

South Carolina, Aiken, 4.

Tennessee, 2; Sewanee, 5; Cumberland Mts., 4; Franklin Co., 8; Monroe Co., 1; Wolf River, 1.

Eastern Tennessee, 7.

Texas, 10.

Virginia, 1; Natural Bridge, 1.

Vermont, Copperas Hill, 1.

Manitoba, Lake of the Woods, 2; Ottertail Lake, Red River of the North, 1.

Canada, 1; Point Levi, Quebec, 2.

New Brunswick, 1.

Nova Scotia, Windsor, 1.

Variation in the intensity and distribution of the color marks, partial suppression and very coarse prominence of the striæ,—the latter in its extreme form in var. *costigera* Bld.,—and flattening of the whorls are the unstable features in this shell, as they are in so many helices presenting the natural phases of oscillation within the limits of specific identity.

Dr. Pilsbry (Nautilus, Vol. XV, p. 6) has recognized the following subspecies:

P. alternata fergusoni (Bld.), New York to Maryland.
" " *rarinotata* Pils., Texas.
" " *carinata* Pils., Pennsylvania to Tennessee.
" " *knoxensis* Pils., Tennessee.
" " *costata* Lewis, Great Smokies.
" " *mordax* Shuttl., Great Smokies.

Costigera Bld. is an unpublished (MS.) collection name, and is possibly synonymous with *costata* Lewis.

Helix (Patula) cumberlandiana *Lea.*

Cat. No. 570. Fig. spec., T. M., pl. 26.
Cat. No. 571. Fig. spec., L. S. N. A., p. 76, fig. 130.
Cat. Nos. 570–572. **Tennessee,** Sewanee, 5.

Helix (Patula) perspectiva *Say.*

Cat. Nos. 573–582.

Georgia, Floyd Co., 7.
Indiana, 5; New Harmony, 8.
Ohio, 1.
Pennsylvania, 2.
Tennessee, 5; Union Co., 4.
Texas, 5.
Virginia, 2.
West Virginia, Lexington, 6.

The variety *carinata* from Union Co., Tenn., is almost planate, and below the periphery the striæ approach extinction. This is a collection name and without published authorization.

Helix (Patula) bryanti *Harper.*

Cat. No. 583. **North Carolina,** Black Mts., 4.

Certainly interchangeable with var. *carinata* of *perspectiva.*

Helix (Patula) striatella *Auth.*

Cat. Nos. 584–597.

Arizona, Moqui Village, 1.
California, Mariposa Co., 2.
Oregon, 2.
Pennsylvania, Canonsburg, 2.
Kansas, 3.
Maine, Orono, 50.
Nevada, White Pine, 9.
Ohio, 4; Circleville, 17.
Canada, Pembina River, 3; Rivière du Loup, 2; 16 Island Lake, 2; Magdalen River, 2.

Amongst these are twelve specimens labelled *P. cronkhitei* Newc., about which Dr. Binney in his 'Manual of American Land Shells' expressed himself as being unable "to decide about its specific distinction from *stratella.*" Dr. Binney has, however, placed *cronkhitei* with *striatella*, and in the examples, in this collection, of the former, no definable difference can be surely indicated. Dr. Pilsbry regards *cronkhitei* as barely distinguishable and its "standing as a subspecies dubious."

Helix (Patula) ruderata *Studer.*

Cat. No. 598. **Colorado,** Ouray Co., 3.

If a distinction between *ruderata* and *striatella* can be reasonably insisted on, it rests in the more obsolescent character of the striæ on the inferior half of the whorls in the former.

Helix (Patula) pauper *Gld.*

Cat. No. 599. One specimen from Petropaulovski, Kamtschatka, and two from Nippon.

The delicately exsert and even character of the striæ distinguish this shell.

Helix (Patula) horni *Gabb.*

Cat. No. 601. Two specimens from Arizona.

This species, placed now by Dr. Pilsbry in the genus *Physanophora* (*Microphysa*), has been the subject of an interesting note by that authority (Nautilus, Vol. XIII, p. 98) in which he indicates the rather misleading features of its figure in Binney's 'Manual.' In the specimens the "cuticular riblets" described by Dall are not evident. Mr. Ashmun has collected this species in Arizona and New Mexico, and Dr. Dall has seen it in "the drift of the Yaqui River, Mexico."

Helix (Patula) asteriscus *Morse.*

The specimen figured in T. M., Vol. IV, pl. lxxvii, fig. 9, ascribed to this collection, is lost.

Cat. Nos. 602–607. Maine, Fort William, north shore of Lake Superior, and Salem, Oregon.

Microphysa incrustata (*Poey*).

Cat. Nos. 608, 609. Seven specimens from Cuba.

Microphysa vortex (*Pfeiff.*).

Cat. No. 610. Fig. spec., L. S. N. A., p. 70, fig. 115.

Cat. Nos. 610–613. **Florida,** 1 ; **Cuba.**

Dr. Pilsbry has substituted *Physanophora* for *Microphysa*, on account of the preoccupation of the latter generic term ; but the latter name has become so imbedded in the nomenclature that it seems an unnecessary violence to disturb it. His remarks (Proc. Acad. Nat. Sci. Phila., Vol. XL, p. 83) can be, however, appropriately quoted : "Of course the miscellaneous collection of small Helices under *Microphysa* in Albers-Marten's 'Die Heliceen' should be to some extent dismembered, as well as the genus as constituted by Binney (Terr. Moll., V), and only the species agreeing in characters of shell and dentition with *H. boothiana*, *H. vortex*, *H. incrustata*, etc., be included. This group then, after the elimination of all snails with narrow, thorn-shaped marginal teeth, will comprise about twenty species of West Indian shells."

Microphysa ingersolli (*Bland*).

Cat. Nos. 615, 616. **Colorado,** Howardsville, 3; **Utah,** Ogden, 2.

Pristiloma lansingi (*Bland*).

Cat. No. 614. **Oregon,** Portland, 2.

The anomalous character of the dentition was pointed out by Dr. Binney, who expressed his belief that "the development of the terrestrial mollusks has been too irregular to admit of our expressing it in any satisfactory system of classification."

Hemitrochus varians (*Menke*).

Cat. No. 617. Fig. spec., T. M., Vol. III, pl. xlvi, as *rhodocheila* Binney.

Cat. Nos. 617–625. Florida, and New Providence, Bahamas.

The varieties α to η inclusive are found, θ and ι are not evidently present.

Helicodiscus lineatus (*Say*).

Cat. Nos. 629–640.

Florida, Ft. Gibson, 4.
Idaho, Salmon River, 3.
Massachusetts, Cambridge, 3.
Maine, Orono, 4.
Lake Michigan, 2.
New Jersey, Squan, 5.
New Mexico, 2.
New York, Greenwich, 10.
Texas, Washington Co., 1.
Canada, Gaspé, St. Anne, 1.

Helicodiscus fimbriatus *Wetherby*.

Cat. No. 641. **Georgia,** Tuccoa Falls, 3.

FAMILY PUPIDÆ.

Holospira roemeri *Pfeiff.*

Cat. No. 626. **Texas,** 13 miles from San Antonio, 2.

Holospira goldfussi (*Menke*).

Cat. Nos. 627, 628. **Texas,** New Braunfels, 1. **Mexico,** 1.

Family STENOGYRIDÆ.

Ferussacia subcylindrica (*Linn.*).

Cat. Nos. 642–652.

Great Britain, 7.
Massachusetts, 20.
Maine, Orono, 11,
Lake Michigan, N. Buffalo, 4.
Michigan, Ann Arbor, 15.
New York, Staten Is., 5 ; Utica, 4.
Oregon, Oregon City, 5.
Washington, Snake River, 2.
Utah, Weber Cañon (4500 ft.), 3.
Manitoba, Red River of the North, 1.

Cœcilianella acicula Müll.

Cat. No. 653. Fig. spec., L. S. N. A., p. 227, fig. 387 (enlarged).
Cat. Nos. 653–654. **Italy,** 3 ; **Florida,** 1.

Stenogyra (Rumina) decollata (*Linn.*).

Cat. Nos. 655–657. **South Carolina,** Charleston, 9 ; with many immature specimens ; Corinthia, 4.

Dr. Binney has observed, with reference to the invariable absence of the apex of this shell, that the effect is much too constant to be accounted for by accident. The calcareous secretion forming a solid cap at the separated whorl is a possible cause rather than consequence of this curious truncation.

Stenogyra (Opeas) oconoides (*D'Orb.*).

Cat. Nos. 663, 664. **Texas,** 30 ; **Jamaica,** 4.

In the Texan specimens the last volution is more globose than in the Jamaican examples, and the average expression of the shells less strict and elongated.

Stenogyra (Opeas) subula *Pfeiff.*

Cat. Nos. 665–671.

Alabama, Mobile, 3.
Florida, 10.
South Carolina, 1.
Bahamas, 4.

Stenogyra (Melaniella) gracillima (*Pfeiff.*).

Cat. Nos. 672, 673. **St. Thomas,** 4.

Specimens show variation in sculpture, the sparse riblets becoming almost obsolete.

FAMILY PUPIDÆ.

Pupa (Pupilla) muscorum *Linn.*

Cat. Nos. 674–680.

Maine, 1; Portland, 19; Casco Bay, 14; Cape Elizabeth, 3.	**New York,** 6. **Germany,** 4.

T. D. A. Cockerell regards it desirable to separate *muscorum* into four races, characterized by the absence of all teeth in the aperture of the shell, or by one, two, or three. It does not appear that these varieties have geographical limitation, and except as a record of structural contrasts even their exact varietal value may be questioned. In reverting to the discussion as to whether this shell should be named *marginata* Drap., Dr. Pilsbry has pointed out that, as Hanley has detected, in the expression "aperture ovate-acuminata, mucrone obtuso," used by Linnæus, the latter's acquaintance with its frequently toothed character is established, and there is "little excuse for rejecting the name *muscorum* in favor of the later *marginata*."

Pupa (Pupilla) blandi *Morse.*

Cat. Nos. 681–684.

Missouri River, Drift, Ft. Berthold, 3. **Nebraska,** 4.	**Nevada,** 1. **Utah,** 3.

Dr. Pilsbry has made this shell a variety of *muscorum*, while Dr. Sterki maintains its specific distinctness. Its swelling and less approximate spine seems readily to distinguish it from *muscorum*, with the latter's sloping volutions and retreating apex.

Dr. Sterki (Proc. U. S. Nat. Mus., 1888) has constructed a formula for the designation of *Pupa* (*Vertigo*) based on the development of the apertural lamellæ. Within the limits of the same species the formula varies considerably, and, as in this species *blandi*, when so many aberrant specimens occur with almost entire apertural margins, confidence in their diagnostic value is shaken.

Pupa (Vertigo) variolosa *Gld.*

Cat. Nos. 685, 686. **Jamaica,** 1.

This specimen was separated by Dr. Sterki from *P. contracta* Say, and is unique in the collection, as No. 685 is lost.

Pupa (Pupilla) pentodon *Say.*

Cat. Nos. 687–690.

Maine, 9.	**Ohio,** 2.
Michigan, 2.	**Texas,** 4.

Inasmuch as Dr. Sterki has admitted that "it is difficult to draw a limit between *Pupa* and *Vertigo*, and *may prove to be impossible*," the retention of *Pupa* and the relegation of *Vertigo* to a subgeneric standing seems ordinary prudence.

Pupa (Vertigo) curvidens *Gld.*

Cat. Nos. 691–695.

Michigan, Ann Arbor, 1; **New York,** Huntington, L. I., 4; **Ohio,** 4.

This species Dr. Binney places under *pentodon*, and the specimens now labelled *curvidens* in the collection have received that name upon the authority of Dr. Sterki. In this connection Dr. Sterki's observation can be profitably remembered: "*P. curvidens* is very variable. The two extreme forms, *gracilis* and *floridana*, would unhesitatingly be regarded as widely distinct species, if not connected by intermediate forms; the latter comes nearest *P. pentodon*, the former resembles some forms of *P. hordeacella* Pilsb." Dr. Sterki has indeed urged the different habitats of these two shells as an adequate justification for their specific separation, *pentodon* preferring low moist, and *curvidens* dry upland localities.

Pupa (Vertigo) decora *Gld.*

Cat. No. 696. **British North America,** Ft. Resolution, Great Slave Lake, 10.

Pupa (Vertigo) corpulenta (*Morse*).

Cat. No. 697. **Utah,** Ogden Cañon, altitude 4500 feet, 4.

Pupa (Vertigo) rowelli *Newc.*

Cat. Nos. 698, 699. **California,** Oakland, 5.

Pupa (Vertigo) californica *Rowell.*

Cat. Nos. 700–702. **California,** Monterey, 12; San Diego, 3.

As is well known, Dr. Sterki has separated this species into five varieties, which appear limited by geographical areas. Of these the Monterey specimens which appear strongly lamellate may represent *trinotata* Sterki, and the less dentulate San Diego examples *diegoensis* Sterki. Dr. Sterki has examined hundreds of specimens of this species and remarks that it "is variable to a very exceptional degree, so that the extreme forms appear to be, or to belong to, quite different species or *even genera*."

Pupa arizonensis (?) *Gabb.*

Cat. No. 703. **Nevada,** White Pine, 25.

This shell, although so labelled, is not *arizonensis* at all. Dr. Sterki has pointed this out in a MS. letter. The slightest inspection shows this. It may be *muscorum*.

Pupa (Leucocheila) fallax *Say.*

Cat. Nos. 704–718.

District of Columbia, 5.
Georgia, 7.
Kentucky, 15.
Louisiana, New Orleans, 3.
Massachusetts, New Bedford, 1.
Mississippi, Natchez, 2.
New Jersey, Burlington, 11.
New York, Staten Island, 6.
Ohio, 8.
Tennessee, Clarkeville, 12.
Texas, Bosque Co., 3; Howardsville, 1.
West Virginia, Lexington, 15.
British North America, Ft. Simson, 12.

This un-Pupa-like shell, in its very wide distribution, raises again interest in the contrasted range of species. The very evenly maintained character of this species at widely separated points suggests the reflection that in a more or less homogeneous geographical area species only represent localized variations, and that a cosmopolitan species in this same area expresses structural rigidity which reluctantly yields its long inherited features to the influences of climate or environment.

Pupa (Leucocheila) modica *Gld.*

Cat. Nos. 719–722.

Alabama, 1. **Georgia,** St. Simons Island, 20. **South Carolina,** 5.

As Dr. Binney remarks, *modica* is *almost* uniformly a smaller shell than *fallax*, but its specific distinctness seems doubtful.

Pupa (Leucocheila) hordacea *Gabb.*

Cat. No. 723. Type, L. S. N. A., p. 240, fig. 416, as *arizonensis;* Man. A. L. S., p. 173, fig. 164; Proc. Acad. Nat. Sci., 1900, 588.

This shell, labelled in the collection *P. arizonensis* Gabb, has become involved in a slight fog of confusion and apparent misconception. Dr. Sterki's statement explains the difficulty attached to this identification; he says: "The shells sent out under this name by Gabb, or at least most of them, are known to be nothing else than *P. fallax*, *e. g.*, those in Smithsonian Inst. Coll., in Coll. of the Acad. of Philadelphia. When I found nothing else in several of the richer private collections, I also began thinking that *P. arizonensis* was nothing else than a synonym of *fallax*, in spite of the description and even more the figure in Binney's work, which seemed to point to something of another kind. But since I have seen the (only) type specimen of that fig. in B. & B. Coll. (Central Park Mus., N. Y.), I know that there is really such a thing as *P. arizonensis* existing."

The specimen referred to is undoubtedly the one figured in 'Land Shells,' Binney & Bland, and in the 'Manual,' but it is also the same species with the shell figured as *Pupa hordacea* Gabb in the Amer. Jour. Conch., Vol. II (1866), p. 331, pl. xxi, fig. 7, and as the reference to *arizonensis* by Binney of this shell is of course subsequent to that publication it seems, as Dr. Pilsbry says, that the name stands *P.* (*Leucocheila*) *hordacea*, or, as Dr. Pilsbry writes it, *Pupoides hordaceus* (Gabb). Full discussion of this question is found in Proc. Acad. Nat. Sci. Phila., Sep., 1900, 588, Pilsbry & Vanatta.

Pupa (Leucocheila) hordacea *Gabb.*

Cat. No. 724. **Utah,** Box Elder Cañon (alt. 4000 ft.), 2.

This identification is plainly wrong, and Dr. Sterki refers the specimens to *blandi*, which they may be, or *muscorum*.

Pupa (Leucocheila) armifera *Say.*

Cat. Nos. 725–737.

Alabama, 2.
Illinois, 15.
Kansas, Ft. Kearney, 20.
Lake Michigan, New Buffalo, 15.
Massachusetts, Boston, 15.
Nebraska, 13.
Ohio, Columbus, 50.
Tennessee, Clarkesville, 7.
Vermont, 15.
Washington, 7.
British America, Ft. Simson, 7.

Pupa (Leucocheila) contracta *Say.*

Cat. Nos. 738–747.

Illinois, Mt. Carmel, 20.
Michigan, Ann Arbor, 50.
New York, Greenwich, 10.
Ohio, 8.
Texas, 80; Bosquet Co., 7.
West Indies, Jamaica, 20.

Pupa (Leucocheila) rupicola *Say.*

Cat. Nos. 748–752.

Georgia, 50 ±. **Florida,** 20. **South Carolina,** 7.

Though Dr. Binney expressed the hope that this species and *corticaria* would prove identical, the systematists are disinclined, apparently with some reason, so far as the shell is concerned, to unite them, and *procera* Gld., made synonymous with *rupicola* by Dr. Binney, is also still isolated by Dr. Sterki.

Pupa (Leucocheila) procera *Gld.*

Cat. Nos. 754–758.

District of Columbia, Washington, 7. **Maryland,** Baltimore, 25. **Texas,** Bosque Co., 3.

Pupa (Leucocheila) holzingeri *Sterki.*

Cat. Nos. 759–761.

Nebraska, 50. **Upper Missouri River,** Ft. Berthold, 100.

These specimens are labelled *rupicola* Say, but have been separated by Dr. Sterki under the above name. They are very generally whiter than *rupicola*, the spire less inclined, and the apertural features more distinct. A MS. note by Dr. Sterki avers that these shells have "no relations to *P. rupicola*."

Pupa (Leucocheila) corticaria *Say.*

Cat. Nos. 762–764.

Illinois, Mt. Carmel, 49.

Pupa (Leucocheila) pellucida *Pfeiff.*

Cat. No. 765.

Texas, New Braunfels, 3 (from Dr. Sterki). **Cuba,** 30 (which Dr. Sterki calls *servilis* Gld. and regards as different from *pellucida*).

Shell minute, translucent, apex white, corneous, volutions pale yellow, fine, aperture oval-quadrate, shell subperforate, lamellæ on columella strongly developed, parietal and palatal denticles less strong or absent, peristome slightly recurved and thickened, suture impressed, outline of spire tapering, surface striate with low separable oblique lines of growth, outer lip faintly sinuate, suggesting a generic reference to *Vertigo.*

With reference to its subgeneric position Dr. Sterki (Proc. U. S. Nat. Museum, Vol. II, 1888, p. 376) has remarked that "in shape and dentition it entirely agrees with *Vertigo*," a position quite firmly denied by Dr. Pilsbry, who considers *servilis* and *pellucida* solely Antillean species.

Pupa (Anthracopupa) vetusta *Dawson.*

Cat. No. 767. Imbedded fossil fragments in Coal Measure shale from Nova Scotia.

Pupa (Sphyradium) edentula *Drap.* var. **alticola** *Ingersoll.*

Cat. Nos. 769, 770. **Colorado,** Rio la Plata, 4.

Ingersoll remarks (Rep. U. S. Geol. and Geog. Surv. Terr. 1874, Special Report on Mollusca, p. 391): "It will not be difficult to recognize this species by its parallel sides, base-like expansion of the last whorl, coarse incremental lines, and edentate aperture. It seems to be an essentially alpine species, none having been found at an elevation less than 8,000 to 9,000 feet."

Its loop-like aperture, entire and smooth, seems characteristic, and indicated by Dr. Pilsbry as "perhaps a recognizable variety."

Pupa (Sphyradium) edentula *Drap.* var. **simplex** *Gld.*

Cat. Nos. 771, 772.

Maine, Orono, 4. **Canada,** Gaspé, 1.

The aperture of *simplex* seems identical with *alticola*, but the striæ are less uniformly raised and the spire is reduced. This variety is regarded by Dr. Pilsbry as "typical *edentula.*"

Pupa (Vertigo) gouldi *Binney.*

Cat. Nos. 773, 774. **New York,** Staten Island, 10.

A MS. note from Dr. Sterki says, "is distinct from *V. gouldi* (*V. callosa* Sterki) but very nearly related to *pygmæa* Drap. of Europe."

It certainly does violence to one's natural impressions to separate these specimens from *gouldi.* The non-striate or inconspicuously striate surface, the four lamellæ, columellas, palatal, basal, and parietal, identify them so exactly with the figure in Dr. Binney's 'Manual' that a distinction seems "more honored in the breach than in the observance." Dr. Sterki's extraordinary facility with these minute forms of course outweighs less experienced opinion.

Pupa (Vertigo) bollesiana *Morse.*

Cat. No. 775. **Maine,** Westbrook, 1.

Pupa (Augustula) milium *Gld.*

Cat. Nos. 776, 777. **New York,** Huntington, Long Island, 35.

Pupa (Vertigo) ovata *Say.*

Cat. Nos. 778–786.

California, 2.
Michigan, Ann Arbor, 6.
New York, Greenwich, 11; Huntington, Long Island, 100; Staten Island, 30.
South Carolina, Cooper River, 2.

The California specimens have been identified by Dr. Sterki as *corpulenta* Morse, which they do not seem to be, if the arrangement of lamellæ (denticles) is a distinctive feature. *P. ovata* may be unusual in California, but these specimens can hardly be placed elsewhere.

From the Michigan specimens Dr. Sterki has separated *pentodon* and *tridentata.*

Pupa (Vertigo) tridentata *Wolf.*

Cat. Nos. 787, 788.

Cat. No. 787. Type (?), Amer. Jour. Conch., Vol. V, p. 198, pl. xvii, fig. 1.

Illinois, Canton, 25.

If this species is to be retained the specimens enumerated seem to meet the requirements of Wolf's description. Dr. Pilsbry retains it in his Check List of North American Land Shells (Proc. Acad. Nat. Sci. Phila., 1889, p. 191). Dr. Pilsbry informs me that the type is in the collection of the Academy of Natural Science, Philadelphia.

Pupa (Vertigo) ventricosa (*Morse*).

Cat. Nos. 789, 790.

Maine, Westbrook, 1. **New York,** Greenwich, 1.

Pupa (Vertigo) oscariana *Sterki.*

Cat. No. 791. **Florida,** Volusia Co., 2.

Pupa (Vertigo) rugosula *Sterki.*

Cat. No. 792. **Florida,** Volusia Co., 5.

Strophia incana (*Binney*).

Cat. No. 794. Fig. spec., T. M., vol. IV, pl. lxxix, fig. 17.

Cat. Nos. 795, 796. Type, T. M., Vol. II, p. 316 (as *maritima* Pfeiff.); Vol. III, pl. lxviii, 5 figs.

Cat. Nos. 794–803. **Florida,** 12; Key Biscayne, 4; Key West, 3.

As is well known, Gould considered this species synonymous with *maritima* Pfeiff., with which certainly it has confusing resemblances. It is usually less robust, less strongly ribbed, and with a more sloping apex. Four young specimens in the collection show the bee-hive form, thin lip, quadrate aperture.

FAMILY HELICIDÆ.

Arion foliolatus *Gld.*

Cat. No. 805. **Without locality.**

This genus *Arion* has been regarded by Mr. Cockerell as misapplied in connection with this species, and *Phenacarion*, a new genus, proposed for its reception (Nautilus, Vol. III, p. 126). It seemed hardly necessary to do more than substitute *Prophysaon*, and under this latter genus the species will probably be placed.

Ariolimax californicus *J. G. Cooper.*

Cat. No. 806. **California,** San Mateo.

Ariolimax niger *J. G. Cooper.*

Cat. Nos. 807, 808. **California,** San Mateo.

Ariolimax andersoni *J. G. Cooper.*

Cat. No. 810. **Without locality.**

Prophysaon hemphilli *Bld. & Binn.*

Cat. No. 811. **Without locality.**

Binneya notabilis *J. G. Cooper.*

Cat. Nos. 812–814. **California,** Sta. Barbara Is., 2; Guadaloupe Is., 220 miles from San Diego, 1.

Hemphillia glandulosa *Bld. & Binney.*

Cat. Nos. 815, 816. **Oregon,** Astoria.

Strobila labyrinthica (*Say*).

Cat. Nos. 817–827.

Florida, 27.
Georgia, 20.
Illinois, 1.
Maine, Orono, 14.
New Jersey, Squam, 1.
New York, Staten Island, 5.
Ohio, Columbus, 9.
Texas, 27; Bosque Co., 1.

A fossil specimen (*H. labyrinthicula* Mich.), from the Department of the Drome in France, is in the collection. It is more depressed and the ribs are finer. It does not seem sensibly different from *H. pseudolabyrinthica* Sandb., given in 'Coquilles Fossiles des Environs de Paris,' Cossman, Vol. IV, pl. xii, figs. 24–26.

Strobila hubbardi (*A. D. Brown*).

Cat. No. 228. Type (?), T. M., Vol. V, p. 261, fig. 153.

Cat. Nos. 828–831.

Georgia, Bonavista, Savannah, 1. **Texas,** Indianola, Calhoun Co., 1. **Jamaica,** 3.

The type is in the A. D. Brown collection at the Acad. Nat. Sci. Phila. (*vide* Pilsbry).

Gonostoma yatesi (*J. G. Cooper*).

Cat. No. 832. **California,** Calaveras Co., 2.

Polygyra auriculata *Say.*

Cat. Nos. 834–841. **Florida,** Florida Keys, 14; St. Augustine, 5; Cedar Keys, 1; Fort George Is., 1; Enterprise, 1; Indian River, 3.

The extremely foliated, reflexed, and complicated outlines of the peristome of this species, evinced less markedly in other species of the same genus, seems to have some relation with the deflexed and inferiorly inclined aperture of this group of shells, and might appear to have some reference to the protection of the animal against invasion. Some curious reflections are suggested upon the possibility of these extremely scrobiculated apertures becoming inimical to the life of a species, as if an organic tendency initiated as a defence became established and strengthened to the point of obstructive interference with its life. These interrupted or constricted apertures are seen also in *Stenotrema* and *Triodopsis*, where they are associated also with inverted oral positions, but of course do not attain the curiously intricate character shown in *auriculata.* The internal teeth placed behind this apertural constriction further defend the animal against attack.

Polygyra uvulifera (*Shuttl.*).

Cat. Nos. 842–848 +.

Florida, Ft. Dallas, 4; Cape Canaveral, 4; Punta Rosa Is., 1; Southwestern Florida, 5; Long Key, 4; Cape Sable, 2.

Variety *minor?* **Florida,** Cedar Keys, 4.

The variety *minor* is a collection label simply. Although quite generally recognized as separate species the approximating ends of two series of *auriculata* and *uvulifera* rather leave the impression that a varietal separation would perhaps better express their relations. Dr. Binney's asseveration that "*P. uvulifera* may be distinguished from *P. auriculata* by the peristome," seems often misleading, nor does the umbilical region afford in young or small specimens much more definite marks of distinction. In both species the ribbing varies from distinctly discrete and raised lines to more smooth surfaces with scarcely exsert lines of growth. Dr. Pilsbry asserts that "they *constantly* differ in the form of the basal lip adjacent to the umbilicus."

Polygyra auriformis (*Bland*).

Cat. Nos. 849–853 and 857.

Georgia, 9; Columbus, 2. **Texas,** Indiana Co., 2.

Apparently in typical specimens quite distinct from *P. avara*.

Polygyra postelliana (*Bland*).

Cat. Nos. 858–863.

Florida, Baldwin, 20 m. E. of Jacksonville, 5.

Georgia, Wayne Co., 2; St. Simons Is., 4.

North Carolina, Ft. Macon, 4.

South Carolina, grove near Charleston, 1.

Polygyra espiloca (*Ravenel*).

Cat. Nos. 864–867.

Georgia, St. Simons Is., 2.

Louisiana, New Orleans, 2.

South Carolina, 3.

Texas, 2.

This shell for its size possesses a very well-developed aperture; in some examples the last whorl somewhat envelops its predecessor, producing a more obvious sutural depression.

Polygyra avara (*Say*).

Cat. No. 868. **Florida,** Lake Monroe, 2.

Polygyra ventrosula (*Pfeiff.*).

Cat. No. 869. **Mexico,** Mazatlan, 1.

Polygyra hindsi (*Pfeiff.*).

Cat. Nos. 870, 871. **Mexico,** 2.

The depleted but evident reflection of the aperture of *ventrosula*, seen in this shell, is interesting, and suggests, taken in connection with the varieties referable to the *auriculata* type, a group arrangement of the Polygyras based on the architecture of the mouth.

Polygyra texasiana (*Mori.*).

Cat. Nos. 872–879.

Indian Territory, Ft. Gibson, 2. **Texas,** 8. **Mexico,** Vera Cruz, 1; Matamoras, 7.

"Revolving rufous band" not seen.

Polygyra triodontoides (*Bland*).

Cat. Nos. 880, 881. **Texas,** 3.

Polygyra mooreana (*W. G. B.*).

Cat. No. 882. Type, T. M., Vol. IV, pl. lxxviii, fig. 24.

Cat. Nos. 882–888. **Texas,** 30; Bosque Co., 2; Washington Co., 1.

Cat. No. 888. Type (? of *P. tholus*), T. M., Vol. IV, pl. lxxviii, fig. 21. Three specimens from Texas.

The type specimen in the collection is pale horn color. Two specimens of *mooreana* are marked var. *minor;* mature but smaller shells.

Polygyra hippocrepis (*Pfeiff.*).

Cat. No. 889. **Texas,** New Braunfels, 1.

In this shell the bulge behind the aperture might seem a variable or occasionally absent feature; Pfeiffer, however, in his original description indicates it (pone aperturam constrictus et gibbosus-inflatus).

Polygyra fastigans (*L. W. Say*).

Cat. Nos. 890–893. **Kentucky,** Henry Co., 3; **Tennessee,** Franklin Co., 1.

There is one specimen marked var. which is smaller than the type specimens, and offers in its sensible but indescribable variation an illustration of Dr. Binney's remark. Dr. Pilsbry makes this a synonym of *P. fastigans* Say. See also synonomy, Manual Amer. Ld. S., p. 270. The apertural teeth vary in this species greatly, and the "stout, subtriangular, excavated, deeply entering tooth" which joins the terminations of the peristome in one specimen is dwarfed into two papillate denticles.

Polygyra jacksoni (*Bland*).

Cat. Nos. 894, 895. **Indian Territory,** 1; Fort Gibson, 1.

Polygyra troostiana *Lea.*

Cat. No. 896. Fig. Spec., L. S. N. A., p. 98, fig. 175.
Cat. Nos. 896, 897. **Tennessee,** Franklin Co., 4.

In cross section this shell, which so closely resembles *fastigans*, presents a less cycloidal outline, being appreciably more planorboid.

Polygyra hazardi (*Bland*).

Cat. Nos. 898–904.

Alabama, Tuscumbia, 3.
Georgia, 1.
Kentucky, Frankfort, 1 ; Mumfordsville, 2.
Tennessee, 2 ; Sewanee, 2.

Polygyra oppilata (*Mori.*).

Cat. Nos. 905, 906. **Florida,** Cedar Keys, 2. **Mexico,** 1.

Polygyra dorfeuilliana *Lea.*

Cat. Nos. 907–919.

Alabama, Coosa River, 1.
Arkansas, Hot Springs, 2.
Indian Territory, Ft. Gibson, 2.
Kentucky, 2.
Louisiana, Ouachita, 3 ; Red River, 2.
Missouri, Springfield, 1.
Texas, 7.

Polygyra ariadne (*Pfeiff.*).

Cat. No. 920. Fig. Spec., T. M., Vol. IV, pl. lxviii, figs. 1, 3, 4.

Cat. Nos. 920, 921. **Mexico,** Tamaulipas, 2.

Polygyra septemvolva (*Say*).

Cat. No. 922. Fig. Spec., T. M., Vol. IV, pl. lxxviii, fig. 17.

Cat. Nos. 922–952. **Florida,** 200 ± ; Cedar Keys, 6 ; Jacksonville, 17 ; St. Augustine, 45. **Georgia,** 5.

The collection very fully illustrates the variations of this species and the irregular disposition of the terminal whorls, also the varying inflection of the columellar peristome.

Polygyra cereolus (*Muhlf.*).

Cat. Nos. 953–964. **Florida,** 25 ; Indian River, 17 ; Indian Pass, 2 ; Egmont Key, 12 ; Key West, 4.

The two specimens from Indian Pass are beautiful large white shells, with flexuous warped superior surfaces, and, in one, with the last whorl strongly elevated at the aperture. The winding of *cereolus* is perhaps more irregular than in *septemvolva*, and at the upper angle of the last volution the carina seems in some examples subtent and marked by a faint constriction.

Polygyra carpenteriana (*Bland*).

Cat. No. 965. Type, L. S. N. A., p 108, fig. 183.

Cat. Nos. 965–981. **Florida,** 18 ; Biscayne Key, 12 ; Sarasota Bay, 10 ; Manatee, 2 ; Indian River, 3 ; Cedar Keys, 8 ; Egmont Key, 7 ; Ft. Dallas, 6 ; Tampa Bay Keys, 4.

The often-expressed doubt as to the validity of this species is rather strengthened by an inspection of the specimens. Mr. Binney's distinctions, based on the "strong, acute rib-like striæ and the peculiarity of the outer whorl," do not seem uniformly present. It is certainly very near if not conspecific with *P. cereolus*.

Polygyra febigeri (*Bland*).

Cat. Nos. 982–984. **Alabama,** Mobile, 40. **Louisiana,** New Orleans, 1 ; Bearhead City, 2.

Polygyra pustula (*Fér.*).

Cat. Nos. 985–991.

Florida, 4 ; St. Augustine, 1.

Georgia, Savannah, 4 ; St. Simons Is., 8.

South Carolina, 4.

Texas, 2.

Polygyra pustuloides (*Bland*).

Cat. Nos. 992–995. **Alabama,** 2 ; Perry Co., 1.

Polygyra leporina (*Gld.*).

Cat. Nos. 996–1001. **Alabama,** Morango, 2. **Indian Territory,** Ft. Gibson, 1. **Texas,** 2.

Polygyrella polygyrella (*Bland*).

Cat. No. 1002. Fig. spec., T. M., Vol. V, pl. i, figs. 12–14.

Cat. Nos. 1002–1004. **Idaho,** Cœur d'Alene Mts., 2 ; White Bird Creek, 1.

The apertural forms of *Polygyra* may be rudely referred to five groups which present a rational basis for an evolutional theory ;

first, the *septemvolva* type, embracing *septemvolva*, *cereolus*, *carpenteriana*, *polygyrella*, *febigeri*, and characterized by an entire margin bent into a cusp upon the columella ; second, the *ventrosula* type, where the bent edge is prolonged into a more or less calloused, tongue-like (linguiform) collar, and including *ventrosula*, *hindsi*, *texasiana*, *triodontoides*, *mooreana*, *fastigans*, *jacksoni*, *troostiana*, *hazardi*, *dorfeuilliana*, *ariadne ;* third, the *hippocrepis* type, where the tongue-like collar becomes an extended loop and is crossed by a high revolute continuation of the parietal peristome, forming a triangular compartment on the shell wall. *Hippocrepis* alone constitutes this type. The fourth type is that of *auriculata*, comprising *auriculata*, *auriformis*, *uvulifera*, *postelliana*, *espiloca* (this species might be placed with *ventrosula* in examples where the supplementary folds are reduced with non-ringent peristome), *avara* (?), *dorfeuilliana*. This type attains the most expanded development of an irregular aperture, becoming trilobate and internally constricted by shelly expansions, folds, etc. The fifth type is represented in *pustula*, where the peristome is deciduously connected by a weak, low lamina narrowing the aperture into a lunate slit, which if enlarged or strengthened would produce a stenotremous-like opening. This type includes *pustula*, *pustuloides*, and *leporina*.

The natural hypothesis that the primitive form of the aperture of *Polygyra* was simple seems strengthened by the fossil form *carpenteriana*, and when the analysis of any of the forms reveals a more or less impeded effort at a simple constriction producing a superior bulge and an inferior auriform palet or loop, with a reflection of the mouth from the shell, the conclusion seems warranted that the more complicated apertures were later in time. If this was true we should expect to find, as we do, the simple and complicated forms in the same district (*auriculata* and *septemvolva* in Florida), while the simple and intermediate forms would be more widely distributed (*septemvolva*, *febigeri*, *ventrosula*, *hippocrepis*, *pustula*, in Texas, Mexico, Alabama, Georgia), with the simplest most widely ranged from its metropolis (*polygyrella* in Idaho).

Stenotrema spinosum (*Lea*).

Cat. Nos. 1005–1008. **Georgia,** 12. **Alabama,** Perry Co., 6. **Tennessee,** 8.

Stenotrema labrosum (*Bland*).

Cat. No. 1009. **Arkansas,** Hot Springs, 2.

Stenotrema edgarianum (*Lea*).

Cat. Nos. 1010, 1011. **Alabama,** 2. **Tennessee,** 1.

In this species the "parietal" (columellar?) tooth is marginally thickened by a refluent callous edge not seen in *stenotremum*. The two specimens from Alabama appear in this respect to be *edgarianum*.

Stenotrema edvardsi (*Bland*).

Cat. No. 1012. **Kentucky,** 4.

Stenotrema barbigerum (*Redf.*).

Cat. No. 1013. **North Carolina,** Hayesville, 2.

Stenotrema stenotremum (*Fér.*).

Cat. Nos. 1014–1028.

Alabama, Clark Co., 1.
Georgia, Fannin Co., 1.
Kentucky, 1; Newcastle, 5; Laurel Co., 3.
Indiana, 2.
Louisiana, Madison Parish, 2, and 2 fossil.
Mississippi, Adams County, 2.
Missouri, Chillicothe, 3.
Tennessee, 4; Bradon Mt., 3.
Texas, 1.
Without locality, 7.

In the fossil forms the "lamelliform tooth" is deficient or undeveloped; it scales off readily, and has probably been lost in this way.

Stenotrema hirsutum (*Say*).

Cat. Nos. 1029–1049.

District Columbia, 4.
Georgia, Fannin Co., 3; Franklin Co., 3.
Indiana, New Harmony, 8
Indian Territory, Ft. Gibson, 1.
Iowa, 1.
Kentucky, 5; Newcastle, 2; Whitley Co., 6; Pulaski Co., 2.
North Carolina, Roan Mt., 2.
Ohio, Circleville, 4; Elyria, 6; Columbus, 9.
Pennsylvania, Allegheny Co., 1; Canonsburg, 2.
Tennessee, Cumberland Mt., 4; Murfreesboro, 3.
Virginia, 4; Green Banner Co., 2.
Without locality, 2.

Stenotrema maxillatum (*Gld.*).

Cat. Nos. 1050, 1051. **Alabama,** 2. **Georgia,** 2.

Stenotrema monodon (*Rack.*).

Cat. No. 1052. Fig. spec., L. S. N. A., p. 122, fig. 203.
Cat. Nos. 1052–1094.

Alabama, 11 ; Perry Co., 4.
Illinois, 4 ; clays in Cass Co., 5.
Indiana, loess, New Harmony, 7.
Indian Territory, 1.
Iowa, 2.
Kentucky, opposite Cairo, 1.
Massachusetts, Berkshire Co., 1.
Michigan, 2 ; Grand Rapids, 3.
Minnesota, St. Paul, 1.
Mississippi, 1.
Missouri, 1 ; Council Bluffs, 4.
North Carolina, Hayesville, 2.
New York, Greenwich, 2.
New Hampshire, North Conway, 5.
Ohio, 4 ; var. *leai*, 12 ; Columbus, 7.
Oregon, mouth of Columbia River, 2.
Pennsylvania, Elk Co., 1 ; Allegheny, 1.
Tennessee, 2.
Texas, Beaumont, 5 ; Waco, 2.
Vermont, Copperas Hill, 1.
Canada, Montreal, 1 ; Point Levi, 1.
New Brunswick, Dalhousie, 1.

This widely distributed *Stenotrema* displays some range of variation in size of shell, in height of spine, width of umbilicus, and development of the "lamelliform tooth." The figured specimen is alluded to by Dr. Binney as "a curious pathological specimen" with a remade peristome showing two successive teeth. The collection possesses two other almost identical examples of this renewal. A number of Say's *fraterna* are in the collection, showing the obliteration of the umbilicus. Along with these are specimens of the glabrous and tightly-coiled *leai*. Dr. Pilsbry writes that "*Stenotrema leai* is the typical *monodon* of Rackett. The larger, less tightly-coiled common shells *(monodon* of Binney *et al.)*, now stand as var. *fraterna* Say."

Stenotrema germanum (*Gld.*).

Cat. Nos. 1094, 1095. **Oregon,** 2.

This species, as in some instances of *monodon*, stretches the limits of the generic separation between *Stenotrema* and *Mesodon*. Specifically, its geographical distribution alone saves it from absorption in *monodon*.

Triodopsis palliata (*Say*).

Cat. Nos. 1096–1120.

Illinois, 4.
Indiana, 6.
Kentucky, 4.
Louisiana, 1.
New York, 1.
Ohio, 3 ; Hamilton Co., 7.
Pennsylvania, Alleghanies, 1 ; Cambria Co., 1 ; Elk Co., 1 ; Tioga Co., 1.
Tennessee, 9; Pittsburg Landing, 2.
Vermont, Orange Co., 1.

Amongst these specimens, one from Ohio and one from Tennessee show a faint white line just below the limit of the last whorl, which on the interior of the shell is seen to be impressed, a faintly elevated ridge being visible. The parietal tooth varies greatly, in size, elevation, and connection of its base with the umbilical callus, and the well-known oscillation of the outline of the whorls from angular to subspherical is well shown. The variety *carolinensis* is represented by five specimens. It is a collection MS. name.

Triodopsis obstricta (*Say*).

Cat. Nos. 1121–1127. **Georgia,** 2. **Kentucky,** Green River, 4. **Tennessee,** 3 ; Franklin Co., 2.

The featural connection between the "stout erect denticle" and the carinal wing on the whorl is well seen, the former terminating on the peristome, the thickened edge of the former. It is also noticeable that the development of this tooth is coequal with the strength and prominence of the carina.

The MS. varieties *planulata* and *carolinensis* are both present.

Triodopsis appressa (*Say*).

Cat. No. 1128. Fig. spec., L. S. N. A., p. 130, fig. 219, as *H. tridentata.*

Cat. No. 1129. Fig. spec., T. M., Vol. V, p. 305, fig. 198, var. *a.*

Cat. Nos. 1128–1159.

Alabama, 4.
Arkansas, 2.
Georgia, 5 ; Savannah, 3.
Illinois, 3.
Indiana, 5.
Kentucky, McLean Co., 1; Henry Creek, 4 ; opposite Cairo, 4.
North Carolina, 1.
Ohio, 3 ; Hamilton, 3.
South Carolina, 1.
Tennessee, 5 ; Nashville, 3.
Virginia, 5 ; Nat. Bridge, 1.
Bermuda, 2.
Without locality, 12.

The figured specimen is pathological and shows two peristomes and a disconnected, very weak parietal tooth. The second mouth constricts the aperture, has a defective thickened peristome, and appears to be an abortive effort on the part of the animal to form a new mouth for the shrunken body. A very peculiar specimen is from Henry Creek, Ky. It shows a strong medial basal fold which terminates at one end in the parietal tooth and at the other forms an emargination on the lip. The Bermuda specimens are pale in color and quite flattened. The parietal tooth varies from a sharply erected triangular blade to a more extended oblique and sometimes repressed denticle.

Triodopsis inflecta (*Say*).

Cat. No. 1160. Fig. spec., L. S. N. A., p. 128, fig. 216 (base view).

Cat. Nos. 1160–1179.

Alabama, 8.
Arkansas, 1.
Georgia, St. Simons Island, 4; Taylor Co., 4; Darien, 2.
Illinois, 1.
Indiana, 5.
Indian Territory, Ft. Gibson, 4.
Kentucky, Henry Co., 5; Mammoth Cave, 3.
Louisiana, 1.
Michigan (?), 6; Adams Co., 5.
Ohio, Circleville, 6.
Pennsylvania, 1.
Tennessee, 3; Natchez, 4; Franklin Co., 3.

The specimens vary widely in size, attaining in individuals from University Place, Franklin Co., Tenn., a diameter of $\frac{5}{8}$ in. (15.87 mm.), with, in this instance, an open and profound umbilicus.

Triodopsis rugeli (*Shuttl.*).

Cat. Nos. 1180–1183.

Kentucky, 7. **Tennessee,** 4; Union, 3; Mophale Springs, 3.

Specimens in the General Museum Collection have a circumperipheral white line.

Triodopsis tridentata (*Say*).

Cat. Nos. 1184–1206.

District Columbia, 3.
Florida, 1.
Indiana, 1.
Kentucky, Lawrence Co., 2; Newcastle, 4.
New Jersey, 2; Bergen Point, 3.
New York, 3; Helderberg Mts., 2; Niagara, 3; Greenwich, 3; Utica, 6.
North Carolina, 4.
Ohio, 11.
Pennsylvania, 3.
Tennessee, 1.

This familiar species shows variations in the strength of the striæ, size of umbilicus, position of peristomal teeth.

Triodopsis fallax (*Say*).

Cat. Nos. 1208–1235.

Arkansas, 1.
Illinois, 2.
Kentucky, 2 ; Whitley Co., 1.
Louisiana, 1.
Maryland, Oakland, 8.
Missouri, Springfield, 3.
New York, Staten Island, 2.
North Carolina, 2.
Ohio, 12.
Pennsylvania, Canonsburg, 2 ; Broad Top Mt., 1 ; Warren, 1 ; Lancaster Co., 3.
Virginia, 2 ; Green Briar Co., (2000 ft.), 2 ; James River, 2 ; Fairfax Co., 2 ; York River, 4.
Tennessee, 1 ; Franklin Co., 2 ; E. Tenn., 8.

Amongst these specimens occur four somewhat aberrant individuals ; one shows the incipient development of a parietal tooth some distance in front of the finished aperture, with almost complete suppression of the upper peristomal tooth ; a second has the lower peristomal tooth doubled ; both of these specimens are flattened.

In the third, the lower peristomal tooth is obliterated, with a marked decumbency of the last whorl below the preceding one, so that the former envelops the latter at less than half its perimeter. The forms from Staten Island are thin, small, and pellucid ; three albino forms from Ohio are to be noted : the smallest specimens, in instances, show a relatively much less expanded umbilicus than the large individuals. This shell Dr. Pilsbry has identified as his own *fraudulenta.*

Triodopsis introferens (*Bland*).

Cat. Nos. 1236–1240.

District of Columbia, Georgetown, 2.
North Carolina, Concord, 1 ; Gaston Co., 1.
South Carolina, Aiken, 1.
Tennessee, Knoxville, 3.

The parietal tooth is generally more arcuate than in *fallax,* but distinctions between *introferens* and *vultuosa* are not convincing in some examples of each species of the same size. *Introferens,* by the displacement of the *fallax* of authors, becomes the *fallax* of Say.

Triodopsis hopetonensis (*Shuttl.*).

Cat. Nos. 1241–1254.

Florida, 5 ; St. Johns River, 3 ; Fort George, 2.

Georgia, Houston Co., 2 ; St. Simons Island, 8 ; Hopeton, 2.

North Carolina, 2.

South Carolina, 6 ; Sullivan Co., 2 ; Charleston, 4.

Without locality, 12.

The difficulties of identification in some instances are illustrated in this series by the conflicting labels, *tridentata* and *fallax*, upon some specimens. It would most readily be confounded with smaller forms of *fallax*, and the distinction of Dr. Binney that its "denticles are more widely separated" than in that species seems often a very minute and questionable feature ; *fallax* is generally larger, and its peristome more expanded and reflexed, though some labelled examples of *fallax*, somewhat depauperate, almost indistinguishably resemble *hopetonensis*.

Triodopsis vannostrandi (*Bland*).

Cat. Nos. 1255–1259. **Georgia,** Augusta, 2. **South Carolina,** 1 ; Aiken, 1. **Without locality,** 3.

Triodopsis vultuosa (*Gld.*).

Cat. Nos. 1260–1264. **Georgia,** 1. **Texas,** Beaumont, 1 ; Orange, 2 ; Eastern Texas, 1.

The variety *henriettæ* Mazyck is represented by one example.

Triodopsis copei *Wetherby*.

Cat. No. 1265. **Texas,** Beaumont, 1.

Specimens of *vultuosa*, so identified by Binney, from Beaumont also, are inseparable from this species.

Triodopsis loricata (*Gld.*).

Cat. Nos. 1266–1272. **California,** Mariposa, 1 ; San Francisco, 9 ; Lone Mt., 6 ; Mendocino Co., 2 ; Mt. Diablo, 1 ; Alameda Co., 2 ; Oakland, 7.

Triodopsis levettei (*Bland*).

Cat. No. 1274. Type, Ann. Acad. Sci. N. Y., II, p. 115, fig.
New Mexico, Santa Fé, 1.

This beautiful and satisfactory species is quite smooth, with appreciable but obsolescent striæ, and sigmoidal parietal tooth.

Triodopsis mullani (*Bland*).

Cat. No. 1275. **Idaho** (?), 1.

A hyaline example, not typically *Mesodon*, depressed spire, and without peristomal teeth, umbilicus half covered.

Triodopsis (Mesodon ?) hemphilli *W. G. B.*

Cat. No. 1276. **Idaho,** Kingston, 2.

Shell with umbilicus closed, translucent, greenish brown to brown ; whorls 5, filiform striate ; suture impressed ; aperture sub-trilobate, auriform ; peristome white with faint chestnut hue, reflexed, thickened, showing on face a median furrow, inner margin without teeth but faintly protuberant on the base, parietal tooth, narrow, isolate, placed one-third of the volution below apex of aperture.

Triodopsis sanburni *W. G. B.*

Cat. No. 1277. **Idaho,** Kingston, 2.

Shell perforate, umbilicus overlapped by peristome ; whorls 5, thin translucent horn, colored, aperture trilobate, peristome white, reflexed, edge divided from body whorl by a deep continuous constriction, provided with two marginal teeth, the basal triangular elongate, the lateral short, rhombic, parietal tooth arcuate oblique, with the long slope inferior.

Mesodon major (*Binn.*).

Cat. Nos. 1278–1305.

Florida, 1.

Georgia, 12 ; Athens, 1 ; Columbus, 6 ; Macon, 2 ; Taylor Mt., 1 ; Taylor Co., 1; northern Georgia, 1.

Kentucky, 1.

North Carolina, Roan Mt., 1.

South Carolina, 1 ; Abbeville Dist., 2 ; Columbia, 2 ; Graniteville, 2.

Tennessee, 2 ; Lookout Mt., 2 ; Philadelphia, 2.

Without locality, 1.

This species varies in the elevation of the spire, the clavicular character of the basal callus, becoming distinctly toothed in one individual (see Binney), and in the solidity and weight of shell. Four specimens of very similar maturity weighed respectively 1.85, 3.01, 4.03, and 6.95 grammes. With one exception these specimens were from Georgia.

The critical question of the specific separation of *major* from *albolabris* is probably not a very useful discussion. Dr. Pilsbry has, however, placed *major* under *albolabris*, and Dr. Binney has practically authorized the change.

Mesodon albolabris (*Say*).

Cat. Nos. 1306–1354.

Arkansas, near Helena, 2.
District of Columbia, Washington, 4.
Georgia, Macon, 2.
Illinois, 1.
Indiana, 1.
Kentucky, 2.
Maine, 2; Casco Bay, 1.
Massachusetts, Marblehead, 3; Manchester, 3.
Michigan, 4; Sault St. Marie, 1.
Minnesota, Vermilion Lake, 1.
Mississippi, Vicksburg, 1; Natchez Bluff (fossil), 3.
Missouri, 3.
New Hampshire, Charlestown, 1.
New York, 6; Greenwich, 2; Staten Island, 2.
Ohio, 8; Strontian Is., Lake Erie, 1.
Pennsylvania, 2; Alleghanies, 2.
Tennessee, 1; University Pl., 2.
Virginia, 4; Natural Bridge, 1; Norfolk, 1.
Canada, Restigouche River, 2.
Without locality, 21.

The posterior surface of the reflexed peristome still retains, in many specimens, an orange epidermal flush of color.

Mesodon divesta (*Gld.*).

Cat. No. 1355. Type, L. S. N. A., p. 139, fig. 233.

Cat. Nos. 1355, 1356. **Arkansas,** 1; Hot Springs, 2.

Mesodon multilineata (*Say*).

Cat. No. 1357. Fig. spec., L. S. N. A., p. 139, fig. 234.

Cat. Nos. 1357–1383.

Illinois, Vermilion River, 1.
Indiana, 10; New Harmony, 4.
Iowa, 1.
Kentucky, Henry Co., 1.
Michigan, 5; Grand Rapids, 3; Kalamazoo, 1.
Minnesota, St. Paul, 2; Vermilion Lake, 2.
New York, 2.
Ohio, 8; Columbus, 5; Circleville, 4; Elyria, 4.
Without locality, 14.

Many examples have the revolving bands almost or entirely suppressed, with sometimes deeper color and again light rosy tints varying to white. A group showing variations in the color stripes exhibits the very unequal number, width, and disposition of these lines. The usual depressed and covered umbilical area, in individuals from Columbus, Ohio, is replaced by a half-covered or entirely open umbilicus, caused by the erect position of the peristomal lip, which is not in these instances reflexed over the umbilical opening. These umbilicated examples are not large shells, neither are they below the average weight of other imperforate shells of the same size.

Mesodon pennsylvanica (*Green*).

Cat. Nos. 1384–1393.

Illinois, 1.
Kentucky, Covington, 3.
Ohio, 11; Circleville, 2; Columbus, 1.
Virginia, 1; Red Sulphur Springs, Monroe Co., 1.
Without locality, 1.

A perforate (umbilicated) example occurs, with the basal limb of the peristome sharply angulated.

Mesodon mitchelliana *Lea.*

Cat. No. 1394. Fig. spec., L. S. N. A., p. 142, fig. 240.

Cat. Nos. 1394–1400.

Kentucky, 4; opp. Cairo, 2.
North Carolina, Cherokee Co., 2.
Ohio, 10; Columbus, 5.
Virginia, 1.
Without locality, 1.

Mesodon elevata *Say.*

Cat. Nos. 1401–1416.

Alabama, Stevenson, 2.
Georgia, 1; Yellow River (?), 1.
Illinois, 6.
Indiana, 1.
Kentucky, 5.
Louisiana, 1.
Mississippi, Vicksburg, 2.
Missouri, St. Louis, 1.
Ohio, 2; Cincinnati, 4.
Tennessee, 2; Jefferson Co., 1; eastern Tennessee, 6.
Without locality, 5.

Umbilicated examples occur in young individuals before the peristome or basal callus has developed. In a fossil example from Louisiana the penultimate whorl overlaps and is separated from the preceding one, forming a sensible groove. This irregularity in the winding is simply individual.

Mesodon clarki (*Lea*).

Cat. No. 1417. **North Carolina,** Cherokee Co., 2.

Mesodon christyi *Bland.*

Cat. No. 1418. **North Carolina,** 1.

A poor exolete broken example.

Mesodon exoleta (*Binn.*).

Cat. Nos. 1419–1435.

Alabama, Walker Co., 2.
Georgia, 3.
Illinois, 3.
Indiana, 4.
Mississippi, Vicksburg (fossil), 2; Natchez Bluff (fossil), 1.
New York, western, 1.
Ohio, 7.
Pennsylvania, Broad Top Mt., 3.
Tennessee, 2; eastern Tennessee, 2.
Without locallity, 6

A large example labelled "type A. B." is certainly not the specimen figured on Pl. X, T. M., Vol. III, unless that figure is reduced in size from the type, and the irregularities of the surface and markings have been omitted. The parietal tooth, even in large specimens, is frequently absent.

Mesodon wheatleyi *Bland.*

Cat. Nos. 1436–1438. **North Carolina,** Hayesville, 1; Roan Mt., 2; **Tennessee,** 1.

Mesodon dentifera (*Binn.*).

Cat. No. 1439. Type, T. M., Vol. III, pl. xii.

Cat. Nos. 1439–1441. **New York,** Livingston Co. 1. **Pennsylvania,** Elk Co., 1. **Vermont,** 1.

Mesodon roemeri (*Pfeiff.*).

Cat. Nos. 1442–1446. **Texas,** Caldwell Co., 1. **Without locality,** 1.

The specimens show the umbilicated and imperforate forms, the parietal tooth present and absent, and the incipient callosity connecting the tooth with the basal margin of the peristome.

Mesodon wetherbyi (*Bland*).

Cat. Nos. 1447, 1448. **Kentucky,** Whitley Co., 2. **North Carolina,** Roan Mt., 2.

A varietal form from Roan Mountain is quite planulate, the last volution subcarinate, green, with the parietal tooth extending across the aperture, and, in one specimen, continuous with the peristome. This varietal form has been referred by Pilsbry to the species *subpalliata.*

Mesodon andrewsi *W. G. B.*

Cat. Nos. 1449–1452. **North Carolina,** 2; Roan Mt., 6.

One very large example has a width of 6.13 mm.

Mesodon ptychophorus (*Brown*).

Cat. No. 1453. Fig. spec., T. M., Vol. V, Suppl. II, pl. i, figs. 3, 16.

Cat. Nos. 1453–1455. **Idaho,** 5.

This variety of *townsendiana* is represented by two forms, one coarsely striate, and a smoother form.

Mesodon thyroides (*Say*).

Cat. Nos. 1456–1510.

Alabama, 3; Prairie Bluff, 2.
Arkansas, 5; near Helena, 2.
District Columbia, Washington, 2.
Georgia, 1; Columbus, 2; St. Johns Is., 1; St. Simons Is., 4.
Illinois, 2.
Indiana, 4; Adamsville, 1.
Kentucky, Henry Co., 2; opposite Cairo, 2.
Louisiana, Madison Parish, 2.
Michigan, 1; Grand Rapids, 2.
Mississippi, 3.
New Jersey, Burlington, 3.
New York, 3; western New York, 3; Long Island, 2; Staten Island, 3.
North Carolina, 4.
Ohio, 11; Cunningham Is., 3.
Pennsylvania, Germantown, 11; Broad Top Mt., 3.
South Carolina, Graniteville, 3.
Tennessee, 2.
Texas, 9.
Virginia, Norfolk, 3; Natural Bridge, 1; Lexington, 4; James River, 3.
Wisconsin, 1.
Without locality, 24.

The thickening of the shell and its increased weight are very marked in some specimens, large individuals being exceeded in weight by much smaller shells whose texture is dense, porcellanous, and somewhat opaque. The marked orange tint on the back of the reflexed lip is noticeable, but this deepening of the epidermal tissue behind the lip is observable in almost all Helicidæ with reflected peristomes. A very aberrant specimen from Indiana has an elevated spire, the volutions free and stepped one above the other. This disengagement has brought the upper edge of the lip of the last volution down below the shoulder of the penultimate whorl, and a callus closely resembling the normal tooth is coincident with it. The development of internal teeth, or denticles, "fulcrums," etc., and the apertural nodes have attracted attention; Godwin Austen, Brot, Moricand, Fischer, Mouquin-Tandon, Lea, Binney, and others have offered suggestions as to their functional significance and origin. The very unequal appearance of the "tooth-like process" in *thyroides*, its complete suppression in some cases, and the range of its development, from a scarcely traceable callus to a conspicuous prominence in others, led the writer to believe that its presence or absence bore some relation to the constriction or enlargement of the aperture itself,—that it was in the nature of a secretion stimulated by pressure at that point. The results, after measuring many shells, were utterly inconclusive. There did seem some connection between the habitat of the specimens and the development of this "parietal tooth," the individuals grown in limestone regions being *generally* characterized by its presence, while those from schistose or serpentine areas are apt to be toothless.

Mesodon bucculenta (*Gld.*).

Cat. No. 1511. Fig. spec., L. S. N. A., p. 149, fig. 254.

Cat. Nos. 1511–1527. **Texas,** 10; Beaumont, 4; Houston, 4; Washington Co., 8. **Without locality,** 22.

Mesodon clausa (*Say*).

Cat. Nos. 1528–1544.

Alabama, 8; Selma, 8.
Indiana, 2.
Indian Terr., 2.
Kentucky, 3; Henry Co., 1; Licking River, 3.
Missouri, 4.
Ohio, 1; Hamilton Co., 5.
Tennessee, 2; Franklin Co., 3.
Without locality, 8.

The specimens from Selma are quite coarsely striated, the striæ becoming riblets.

Mesodon columbiana (*Lea*).

Cat. Nos. 1545–1559.

California, 17; Oakland, 2; Mendocino Co., 1; San Francisco, 2; San Leandro, 2; Santa Cruz, 3.

Oregon, Portland, 2; Salem, 1.

Sitka, 2.

Without locality, 3.

There is a marked tendency in this shell to produce a straight margin at the basal portion of the aperture.

Mesodon downieana (*Bland*).

Cat. No. 1560. **Kentucky,** Whitley Co., 1.

Mesodon lawi (*Lewis*).

Cat. No. 1561. **North Carolina,** Playesville, Clay Co., 2.

Mesodon jejuna (*Say*).

Cat. Nos, 1562–1566.

Florida, Indian River, 3; Sarasota Bay, 2; St. Augustine, 1.

Georgia, Savannah, 3; St. Simons Is., 2.

Mesodon mobiliana (*Lea*).

Cat. Nos. 1567–1570. **Alabama,** Mobile, 1. **Florida,** Jacksonville, 4. **Georgia,** Brunswick Co., 3.

Mesodon devia (*Gld.*).

Cat. Nos. 1571–1577.

Idaho, 2; Salmon River, 3.

Oregon, 2; Cascade Mts., 2; near Dalles, 2.

Washington, 3; banks of Snake River, 2.

Some forms are almost planorbal, the spire has so little elevation. Two specimens represent Mr. Binney's (not Cooper's) *Triodopsis harfordiana*, having a flat spire, large parietal tooth, two denticles on the peristome, with an evident dilatation of the apertural margin between them.

Mesodon profunda (*Say*).

Cat. Nos. 1578–1593.

Indiana, 5.
Iowa, 1.
Louisiana, 2.
Minnesota, St. Paul, 2.
Missouri, 1.
New York, 1.
Ohio, 8.
Pennsylvania, Broad Top Mt., 1 ; Elk Co., 1.
Tennessee, Knoxville, 2 ; Vicksburg, 1.
Virginia, 1 ; Natural Bridge, 1.
West Virginia, 1.
Wisconsin, 3.
Without locality, 5.

Mesodon sayii *Binney.*

Cat. Nos. 1594–1609.

Kentucky, 1 ; Whitley Co., 1 ; Big Hill, Jackson Co., 1.
Maryland, 1.
New York, 2.
Pennsylvania, Broad Top Mt., 2 ; Elk Co., 1.
Tennessee, Campbell Co., 3.
Canada, Toronto, 2.
Without locality, 3.

The large specimens from Tennessee have no parietal tooth, and the basal denticle is obsolescent.

Mesodon armigera *Ancey.*

Cat. No. 1610. Fig. spec., T. M., Vol. V, Suppl. II, pl. i, fig. 1.
Cat. Nos. 1610, 1611. **California,** San Francisco, 4.

Acanthinula harpa (*Say*).

Cat. No. 1612. **Kamtschatka,** Petropaulovski, 1.

Vallonia pulchella (*Müll.*).

Cat. Nos. 1613–1631.

Iowa, Davenport, 2.
Kansas, 15.
Maine, Orono, 20.
Michigan, 2.
Nebraska, 4.
Nevada, White Pine, 16.
New Jersey, Mt. Holly, 7 ; Burlington, 4.
New Mexico, 3.
New York, Canandaigua, 4 ; Staten Island, 50.
Pennsylvania, Pittsburg, 13 ; Philadelphia, 1.
Utah, Logan Cañon, 5.
Canada, Berthier, 2 ; Montreal, 4.
England, 6.

The variety *costata* from Utah was taken at an altitude of 5000 feet. The numerous species recognized in the dismemberment of the old *pulchella* are not separately indicated in the collection.

Fruticicola hispida (*Linn.*).

Cat. Nos. 1632–1634. **Nova Scotia,** Halifax, 3. **England,** Norfolk, 6. **Germany,** 2.

Fruticicola rufescens (*Penn.*).

Cat. Nos. 1635, 1636. Quebec, 2; Heidelberg, 3.

Apparently in both of the above European species there is shown a tendency to dwarfing in the American forms. In *rufescens* this is more conspicuous.

Dorcasia berlandieriana (*Moric.*).

Cat. No. 1637. Fig. spec., T. M., Vol. III, pl. xlix, fig. 2.

Cat. Nos. 1637–1648. **Texas,** 30, from the following localities: Clifton, Comal Co.; San Jose, Washington Co.

Dorcasia griseola (*Pfeiff.*).

Cat. Nos. 1649–1651. **Texas,** Cameron Co., 6. **Mexico,** 2.

Turricula terrestris (*Chemn.*).

Cat. No. 1652. **South Carolina,** St. Peters Church, Charleston.

Aglaia fidelis (*Gray*).

Cat. No. 1653. Fig. spec., T. M., Vol. III, pl. xviii, 2 figs.

Cat. Nos. 1653–1680.

California, Eureka, 3; Humboldt Co., 16; Mt. Shasta, 1.

Oregon, 12; Dalles City, 3; Astoria, 2; Portland, 2.

Washington, 2; Columbia River, 3.

Without locality, 5.

An albino specimen in the collection has its upper surface a bleachy white, with the lower surface pale yellow green. Two specimens labelled "raised by J. H. Thomson at New Bedford" are small, far below the average size, but have rather disproportionately thickened lips.

Aglaia infumata (*Gld.*).

Cat. Nos. 1681, 1682. **California,** Marin Co., 1; Mendocino Co., 2.

The surface characters shown enlarged by Dr. Binney in his Manual of American Land Shells' offer a fair criterion for specific identification when compared with *fidelis*.

Aglaia hillebrandi (*Newc.*).

Cat. Nos. 1683, 1684. **California,** Calaveras Co., 1 ; Tuolumne Co., 1.

Arionta arrosa (*Gld.*).

Cat. Nos. 1685–1693. **California,** Marin Co., 6 ; San Mateo Co., 2 ; Santa Cruz Co., 3 ; near San Francisco, 1 ; 40 miles south of San Francisco, 1. **Without locality,** 1.

One albino specimen, a green and thin shell from south of San Francisco, is in the collection, lip broken but probably without peristomal reflexion and callus.

Arionta townsendiana (*Lea*).

Cat. Nos. 1694–1703. **Idaho,** northwestern, 5. **Oregon,** 3 ; Amatilla Co., 1 ; Astoria, 3 ; Portland, 1. **Washington,** 7.

In this species the roughness, malleation, and textural inequalities of the last whorl, from a point one quarter to one half of the circumference behind the aperture, is conspicuous in many specimens. At this point there is often a swelling or protuberant angle which seems to mark the last rapid forward development of the shell.

In a group of smaller specimens from Idaho this final phase does not seem to be present, and the shell terminates with an evenly striate and uninterrupted surface. A node-like callus appears on the parietal wall of one specimen. The soft anatomy shows this species to be a "*Mesodon.*"

Arionta tudiculata (*Binn.*).

Cat. No. 1704. Type, Bost. Jour. Nat. Hist., Vol. IV, pl. xx; T. M., Vol. III, pl. xvi.

Cat. Nos. 1704–1712. **California,** 1 ; Copperopolis, 1 ; Mendocino Co., 2 ; San Diego, 5 ; San Pedro Landing, 3; Tuolumne Co., 1. **Without locality,** 2.

The specimen from Copperopolis is figured in Dr. Binney's 'Manual' as a variety under the name *cypreophila* (p. 140, fig. 119).

Arionta nickliniana (*Lea*).

Cat. No. 1713. Fig. spec., T. M., Vol. III, pl. vi*a*.

Cat. No. 1714. Fig. spec., T. M., Vol. IV, pl. lxxvi, fig. 5. (Type of *anachoreta* W. G. B.)

Cat. Nos. 1712–1728.

California, 6; San Rafael, Marin Co., 1; Mariposa Co., 1; San Francisco and vicinity, 6; Contra Costa Co., 4; Tomales, 2; Mendocino Co., 2.
Washington, Puget Sound, 1.

The variations in size amongst these specimens are extreme, as also in surface characters, height of spire, and lip consistency.

Arionta ayresiana (*Newc.*).

Cat. Nos., 1729–1731. **California,** San Miguel Is., 4 (one fossil); Santa Rosa Is., 1.

Arionta redimita (*W. G. B.*).

Cat. No. 1732. Type, T. M., Vol. III, pl. vi, fig. 1 (as *nickliniana*).

Cat. Nos. 1732, 1733. **California,** 2.

Arionta intercisa (*W. G. B.*).

Cat. No. 1734. Type, T. M., Vol. III, pl. vi, fig. 1 (middle figure as *nickliniana*).

Cat. No. 1735. Fig. spec., T. M., Vol. V, p. 361, fig. 241 (as *crebristriata*); L. S. N. A., p. 167, fig. 290.

Cat. Nos. 1734–1739. **California,** 3; San Clemente Is., 4 (two fossil).

The type shows the callus connecting the ends of the lip along the body whorl of the shell. This in the fossil specimens is far more developed, and the peristome is coarsely and abundantly thickened.

Arionta kelletti (*Forbes*).

Cat. No. 1740. Fig. spec., T. M., Vol. V, p. 361, fig. 242.

Cat. Nos. 1740–1745. **California,** 1; San Diego, 1; Catalina Is., 11.

The overlapping basal blade of the peristome covers the umbilical opening with a thin shelly film.

Arionta stearnsiana (*Gabb*).

Cat. Nos. 1746–1750. **California,** 1; Coronado Is., 6; San Diego, 3; Todos Santos Bay, 3.

Arionta exarata (*Pfeiff.*).

Cat. No. 1751. Fig. spec., T. M., Vol. V, p. 363, fig. 244; L. S., p. 168, fig. 292.

Cat. Nos. 1751–1756. **California,** Santa Cruz, 10; near San Francisco, 4.

Arionta ramentosa (*Gld.*).

Cat. Nos. 1757–1790. **California,** 18; Healdsburg, 2; Half Moon Bay, 2; Contra Costa Co., 2; Alameda Co., 5; Oakland, 13; Santa Clara Co., 1; Santa Cruz, 1; San José Mission, 2; San Francisco, 18; Coast Range, 2.

Wide variations are prevalent in this species. The collection contains the two varieties *bridgesi* and *reticulata.* The differing or contrasted umbilical pit, the varying strength of the revolving band, the flatness or acuteness of the spire, the divergent development of the surface sculpture, the oblateness or sphericity of the body whorl are noticeable features which emphasize its varietal separation from *A. californiensis.*

Arionta californiensis (*Lea*).

Cat. No. 1791. Fig, spec., T. M., Vol. III, pl. vi, fig. 2.

Cat. Nos. 1791–1797. **California,** 5; Monterey, 5; Tomales, Marin Co., 3.

Arionta carpenteri (*Newc.*).

Cat. No. 1798. **California,** Coronado Is., 2.

Arionta mormonum (*Pfeiff.*).

Cat. No. 1799. Fig. spec., T. M., Vol. V, p. 367, fig. 248.

Cat. Nos. 1799–1805. **California,** 1; Calaveras Co., 2; Sacramento Valley, 1; Stanislaus Co., 1; Tuolumne Co., 5.

The variety *circumcarinata* is represented by one specimen from Stanislaus Co. Dr. Pilsbry writes: "*A. circumcarinata* Stearns, has no specific relationship with *mormonum.* Neither Binney or anybody else ever saw any intermediate examples."

Arionta sequoicola *Cooper.*

Cat. No. 1806. Fig. spec., T. M., Vol. V, p. 368, fig. 249.
Cat. Nos. 1806–1808. **California,** 3; Santa Cruz, 2.

Arionta diabloensis (*Cooper*).

Cat. Nos. 1809–1811. **California,** Alameda Co., 2; Oakland, 3.

Arionta traski (*Newc.*).

Cat. Nos. 1812–1820. **California,** 3; Coronado Is.,1; Los Angeles, 1; Santa Barbara, 2; San Diego, 1; Ventura Co. (?), 2. **Lower California,** 2.

Arionta dupetithouarsi (*Dsh.*).

Cat. Nos. 1821–1825. **California,** Monterey, 12.

Arionta ruficincta (*Newc.*).

Cat. No. 1826. **California,** Catalina Is., 2.

Arionta gabbi (*Newc.*).

Cat. Nos. 1827–1834. **California,** Santa Barbara, 14; Catalina Is., 3; St. Nicolas Is., 4; San Clemente Is., 1.

The last volution is unequally globose in specimens, and in the Santa Barbara examples there is shown a tendency to elevate the spire by a protracted coil.

The group *Arionta* furnishes, or might be made to furnish, reflections on the influence of isolation, or what the Rev. Mr. Gulick more descriptively named "Divergent Evolution through Cumulative Segregation." This section of Californian pulmonates offers some close specific approximations in conjunction with geographical isolation. Dr. Binney has indicated this in his remarks on the genus (Manual American Land Shells, p. 126): "The geographical distribution of the species is very peculiar. *A. Townsendiana* belongs to the Oregon fauna. *A. Mormonum* belongs to the Sierra Nevada counties, as does *A. tudiculata*, which also is found in southern coast counties. All the others are restricted to the coast counties, the following being island species: *A. ruficincta*, *Gabbi*, *intercisa*, *Ayersiana*, and *Kelletti*. *A. Stearnsiana* and *Carpenteri* are Lower Californian species."

It would be irrelevant to discuss Mr. Gulick's very elaborate analysis of the kinds and results of segregation, but when we consider the slight differentiations of some of the Ariontas and their sensibly limited habitats Mr. Gulick's speculations upon the extraordinary diversity of the Achatinellidæ the contiguous valleys of the Sandwich Islands seem applicable to them. *Exarata* and *arrosa* are mutually divergent along lines of geographical contact from some common ancestor. *Townsendiana*, from a wider zonal separation, assumes stronger specific traits. If *ramentosa* and *diabloensis* are varieties of *californiensis* their geographical excursion beyond the Monterey sub-region is responsible for it. *Nickliniana* seems much more likely referable to a specific sundering from *townsendiana*, *exarata*, and *arrosa*. The strong features of *mormonum* have evolved through a longer and more complete separation. *Dupetithouarsi*, which is an occupant of the Monterey sub-region, is so contrasted with *californiensis*, while referable to the more northern species, that it must be regarded as an invader of this southern coast region. *Sequoicola* may be regarded as a differentiate from *mormonum*, or *mormonum* is the intensive form of *sequoicola* developed by environment and segregation. *Kelletti* and *stearnsiana* are related or derivative forms, and evince surface characters that are related to geographical areas contrasted with those farther north. The island species, *gabbi*, *ruficincta*, have enjoyed prolonged isolation and have evolved strong ringent calloused peristomes. *Traski* is an offshoot from *sequoicola* or *mormonum* recently introduced upon some of the islands.

Glyptostoma newberryanum *W. A. B.*

Cat. No. 1835. Type, T. M., Vol. IV, pl. lxxvi, fig. 7.

Cat. Nos. 1835–1839. **California,** San Diego, 8; 21 m. northeast of San Diego, 2.

Euparypha tryoni (*Newc.*).

Cat. Nos. 1840–1846. **California,** 6; San Nicolas Is., 3 (2 fossil); Santa Barbara, 12 (3 fossil).

Tachea hortensis (*Müll.*).

Cat. Nos. 1847–1858.

Massachusetts, 12; Kettle Is., 5; Magnolia, 2; Manchester, 3. **Canada,** Gaspé, 2; Hare Is., 1. **Europe,** 9.

Environment or changed conditions do not seem to have in any way modified the specific character of this shell.

Pomatia aspersa (*Müll.*).

Cat. Nos. 1859–1862. **South Carolina,** Charleston, 4. **Europe,** 3. **Hayti,** 2.

FAMILY CYLINDRELLIDÆ.

Cylindrella poeyana (*D'Orb.*).

Cat. Nos. 1863–1869. **Florida,** 4. **Texas,** 1. **Cuba,** 6 (*variegata*); Matanzas, 7.

Cylindrella jejuna *Gld.*

Cat. Nos. 1870–1872. **Florida,** 3.

Macroceramus pontificus (*Gld.*).

Cat. No. 1873. Fig. spec., L. N. S. A., p. 220, fig. 375.

Cat. Nos. 1873–1876. **Florida,** southern part, 2. **Texas,** 2; Atascosa Co., 3. **Central America,** 1.

A large specimen from Central America is recorded as *kieneri*, and as a "Type from Pfeiffer's Cabinet." There is noticeable in it a peculiar deceptive angulation in the whorls, produced by contact of light and darker patches along a white line. This indeed is also seen less conspicuously in *M. pontificus*. It is doubtless a trivial distinction.

Macroceramus glossei (*Pfeiff.*).

Cat. Nos. 1879–1884.

Florida, Sarasota Bay, 7.	**Cuba,** 1.
Bahamas, New Providence, 2.	**Jamaica,** 9.

The Floridian shells have been separated by Pilsbry as *M. floridanus*.

FAMILY BULIMULIDÆ.

Bulimulus patriarcha *W. G. B.*

Cat. No. 1885. Type, T. M., Vol. IV, pl. lxxx, fig. 13.

Mexico, Buena Vista.

Bulimulus alternatus (*Say*).

Cat. No. 1886. Fig. spec., T. M., Vol. III, pl. li *b* (figured as *dealbatus*).

Cat. No. 1887. Fig. spec., T. M., Vol. IV, pl. lxxx, fig. 1.

Cat. No. 1888. Fig. spec., L. S. N. A., p. 203, fig. 349 (figured as *mariæ*).

Cat. Nos. 1886–1899. **Texas,** 13; Laredo, 1. **Mexico,** Tamaulipas, 12.

Bulimulus schiedeanus (*Pfeiff.*).

Cat. No. 1900. Fig. spec., T. M., Vol. IV, pl. lxxx, fig. 8.

Cat. No. 1901. Fig. spec., T. M., Vol. V, p. 392, fig. 279 (as var. *mooreanus*).

Cat. No. 1902. Fig. spec. (?), L. S. N. A., p. 205, fig. 355 (as var. *mooreanus*).

Cat. Nos. 1900–1921.

Texas, 45 (about half var. *mooreanus*); Washington Co., 26; Bosque Co., 1; De Witt Co., 2. **Mexico,** 4; Leon, 4 (var. *mooreanus*).

A number of examples occur in the collection with black or livid apices, and yellow sub-volutional areas, which are to be assigned to *mooreanus*. The wide range in form is well shown. One specimen exhibits a curious oblique white stripe over the body volution, a probable vestige from injury. A very discernible equatorial angulation appears on the last whorl of many individuals, probably immature; the "light delicate waxen vittæ upon the first two whorls" are only occasional, as Dr. Binney remarks.

Bulimulus dealbatus (*Say*).

Cat. No. 1922. Fig. spec., T. M., Vol. III, pl. li *a* (outer figs.).

Cat. Nos. 1922–1935.

Alabama, 2; Marengo Co., 7.
Kentucky, Henry Co., 4.
North Carolina, 1.
Tennessee, Nashville, 5.
Texas, 26; Austin, 12; Comanche Peak, 3.

Variations in the markings and surface coloring are extreme, unichrome individuals occur, passing through those with faint rubescent and bluescent streaks to the marbled surfaces, in which dendritic bands of ashen green and white alternate, and reciprocally predominate in different individuals.

Bulimulus serperastrus (*Say*).

Cat. No. 1936. **Mexico,** 1.

Bulimulus multilineatus (*Say*).

Cat. No. 1937. Fig. spec., T. M., Vol. III, pl. lviii (as *virgulatus*).

Cat. Nos. 1937–1939. **Alabama** (?), 1. **Hayti,** 1. **Venezuela,** 1

Bulimulus dormani *W. G. B.*

Cat. 1940. Type, T. M., Vol. IV, pl. lxxx, fig. 10.

Cat. Nos. 1940–1942. **Florida,** near Suwannee River, 1; Halifax River, near Port Orange, 2; St. Augustine, 1.

Two specimens from Port Orange are exceedingly fragile and hyaline, and resemble *marielinus* in texture.

Bulimulus maculatus (*Lea*).

Cat. No. 1943. **Nicaragua,** 1.

Bulimulus marielinus (*Poey*).

Cat. No. 1944. Fig. spec., Manual L. S., p. 408, fig. 450.

Cat. Nos. 1944, 1945. **Florida,** southern part, 3. **Cuba,** 5.

FAMILY ORTHALICIDÆ.

Liguus fasciatus (*Müll.*).

Cat. No. 1947. Fig. spec., T. M., Vol. III, pl. lvi (lower fig.).

Cat. No. 1948. Fig. spec., T. M., Vol. III, pl. lvii (central left-hand fig.).

Cat. No. 1949. Fig. spec., T. M., Vol. III, pl. lv (central figs.).

Cat. No. 1950. Fig. spec., T. M., Vol. III, pl. lvii (central right-hand fig.).

Cat. Nos. 1947–1964. From **Cuba** and **Florida,** without definite localities.

The three varieties mentioned by Mr. Binney are well represented, but the rosy apex and columellar margin seem associated with other forms, as well as with those bearing brown bands or spots.

Orthalicus undatus (*Brug.*).

Cat. No. 1965. Fig. spec., T. M., Vol. IV, pl. lxxvii, fig. 13.

Cat. No. 1966. Fig. spec., T. M., Vol. III, pl. liv (as *zebra*, lower central fig.).

Cat. No. 1967. Fig. spec., T. M., Vol. III, pl. liv (as *zebra*, upper central fig.).

Cat. Nos. 1965–1973. **Florida,** 3; Key West, 1; Sandy Key, 5. **Jamaica,** 2.

The first of the above-figured specimens Dr. Pilsbry refers to "typical *O. princeps*"; the second to *O. undata reses;* the third, he remarks, "is unknown, the heavy columella being unlike any species known to me, and very unlike *undatus*."

FAMILY HELICIDÆ.

Punctum pygmæum (*Drap.*).

Cat. Nos. 1974–1979.

California, Lone Mt., 6; near San Francisco, 4.

Maine, Orono, 20.

New York, Staten Island, 2.

Texas, 2.

Europe, 10.

FAMILY SUCCINIDÆ.

Succinea haydeni *W. G. B.*

Cat. No. 1980. Type, T. M., Vol. IV, pl. lxxix, fig. 1.

Cat. Nos. 1980–1983. **Indian Territory,** Fort Gibson, 2. **Utah,** near Salt Lake City, 6.

Succinea retusa *Lea.*

Cat. Nos. 1984, 1984*a*. **Indiana** (?), 4.

Succinea sillimani *Bland.*

Cat. Nos. 1985–1988. **California,** Antioch, 1; Stockton, 6. **Utah,** near Salt Lake City, 10.

Succinea ovalis *Gld.*

Cat. Nos. 1989–2002.

Illinois, 2.

Iowa, 6.

Michigan, 1; Ann Arbor, 5.

Minnesota, 1.

New Jersey, Burlington, 2.

New York, Greenwich, 5; Herkimer Co., 9; Lake Champlain, 2; Mohawk, 5; Otsego, 4.

Wisconsin, Milwaukee, 7.

Succinea higginsi *Bland.*

Cat. No. 2003. Put-in-Bay, Lake Erie, 3.

Succinea concordialis *Gld.*

Cat. Nos. 2004, 2005. **Texas,** 6.

Succinea luteola *Gld.*

Cat. Nos. 2006–2013.

Florida, 15; Long Key, 2.

Mississippi, Natchez, 30 ±.

Texas, 2; Washington Co., 4; Brownsville, 3.

Mexico, Matamoras, 3.

Succinea lineata *W. G. B.*

Cat. Nos. 2014–2019.

Arizona, 7.
California, Hollister, 5.
Idaho, Franklin, 6.
Nebraska, Platte River, 2.
British America, Ft. Simpson, 7.

Succinea avara *Say.*

Cat. Nos. 2020–2055.

Alabama, Columbus, 1.
Colorado, 4.
District of Columbia, 1.
Georgia, St. Simons Is., 15.
Idaho, Salmon River, 3.
Illinois, 20.
Maine, 1; Orono, 11.
Michigan, Grand Rapids, 20.
New Mexico, 17.
New Jersey, Squan, 1.
New York, Crown Point, 2; Greenwich, 7; Mohawk, 3; Staten Island, 6; Ticonderoga, 8; Utica, 4.
North Dakota, Pembina, 2.
Ohio, 2; Elyria, 6; Columbus, 7.
Pennsylvania, Germantown, 9.
Vermont, 2.
Virginia, Alexandria Co., 2.
West Virginia, Lexington, 8.
Wisconsin, Milwaukee, 1.
Quebec, Metis Co., 1; Magdalen, 1.
Without locality, 20.

Succinea stretchiana *Bland.*

Cat. Nos. 2056, 2057. **Nevada,** Washoe Co., 1. **Oregon,** 1.

Succinea aurea *Lea.*

Cat. Nos. 2058–2061. **New York,** Staten Island, 15. **Ohio,** Springfield, 2.

Succinea grœnlandica *Beck.*

Cat. No. 2062. Type, figured, T. M., Vol. III, pl. lxxx, fig. 4.

Cat. Nos. 2062, 2063. **Greenland,** 2.

Succinea obliqua *Say.*

Cat. No. 2064. Fig. Spec., T. M., Vol. III, pl. lxvii *b*, fig. 3 (four individuals).

Cat. Nos. 2064–2098.

Arkansas, 1.
Georgia, 4.
Illinois, 5.
Mississippi, Vicksburg, 1.
New Jersey, 2.
New York, Niagara, 10; Mohawk River, 12; Trenton Falls, 2; Greenwich, 1.
Ohio, 14; Birmingham, 3; Columbus, 9; Elyria, 2.
Vermont, 1.
West Virginia, Lexington, 7.
Wisconsin, Milwaukee, 4.
Canada, Gaspé, Magdalen River, 1; Restigouche, 1; Rivière Rouge, 1; Rivière du Loup, 1; Trois Pistoles, 1; Winnipeg, 1.
New Brunswick, Dalhousie, 2.
Without locality, 14; fossil, 1.

Succinea totteniana *Lea.*

Cat. No. 2099. Fig. Spec., T. M., Vol. III, pl. lxvii *b*, fig. 2.

Cat. Nos. 2099–2105.

Connecticut, 5.
Maine, 1 ; Orono, 4.
Massachusetts, Marblehead, 8.
New York, Greenwich, 6 ; Staten Island, 5.
Rhode Island, 1.

Succinea campestris *Say.*

Cat. No. 2106. Fig. Spec., T. M., pl. lxvii *b*, fig. 1.

Cat. Nos. 2106–2123.

Alabama, 2.
Florida, 53 ; Sarasota Is., Baldwinsville, 3.
Georgia, Savannah, 6; St. Simons Is., 11.
Louisiana, New Orleans, 4.
South Carolina, Charleston, 2 ; Sullivans Island, 22.

Succinea rusticans *Gld.*

Cat. Nos. 2124, 2125. **Nevada,** White Pine, 4.

Succinea nuttaliana *Lea.*

Cat. Nos. 2126–2130.

California, 8.
Idaho, Lewis River, 1.
Illinois, 2.
Montana, Bitter Root Valley (elevation 2500–4500 ft.), 1.
Oregon, 1 ; Portland, 1.

Succinea oregonensis *Lea.*

Cat. Nos. 2131–2134. **California,** San José, 2. **Idaho,** 2 ; Cottonwood Creek, 1.

Succinea effusa *Shuttl.*

Cat. Nos. 2135, 2136. **Florida,** Spring Garden Lake, 1. **Texas,** 2.

Succinea salleana *Pfeiff.*

Cat. No. 2137. Fig. Spec., T. M., Vol. IV, pl. lxxix, fig. 18.

Cat. Nos. 2137, 2138. **Louisiana,** Alexandria, 1 ; New Orleans, 2.

Succinea haleana *Lea.*

Cat. No. 2139. Fig. Spec., L. S. N. A., p. 259, fig. 460.

Cat. No. 2139. **Louisiana,** Alexandria, 1.

Succinea mooresiana *Lea.*

Cat. No. 2140. **Nebraska,** Platte River, 1.

Succinea grosvenori *Lea.*

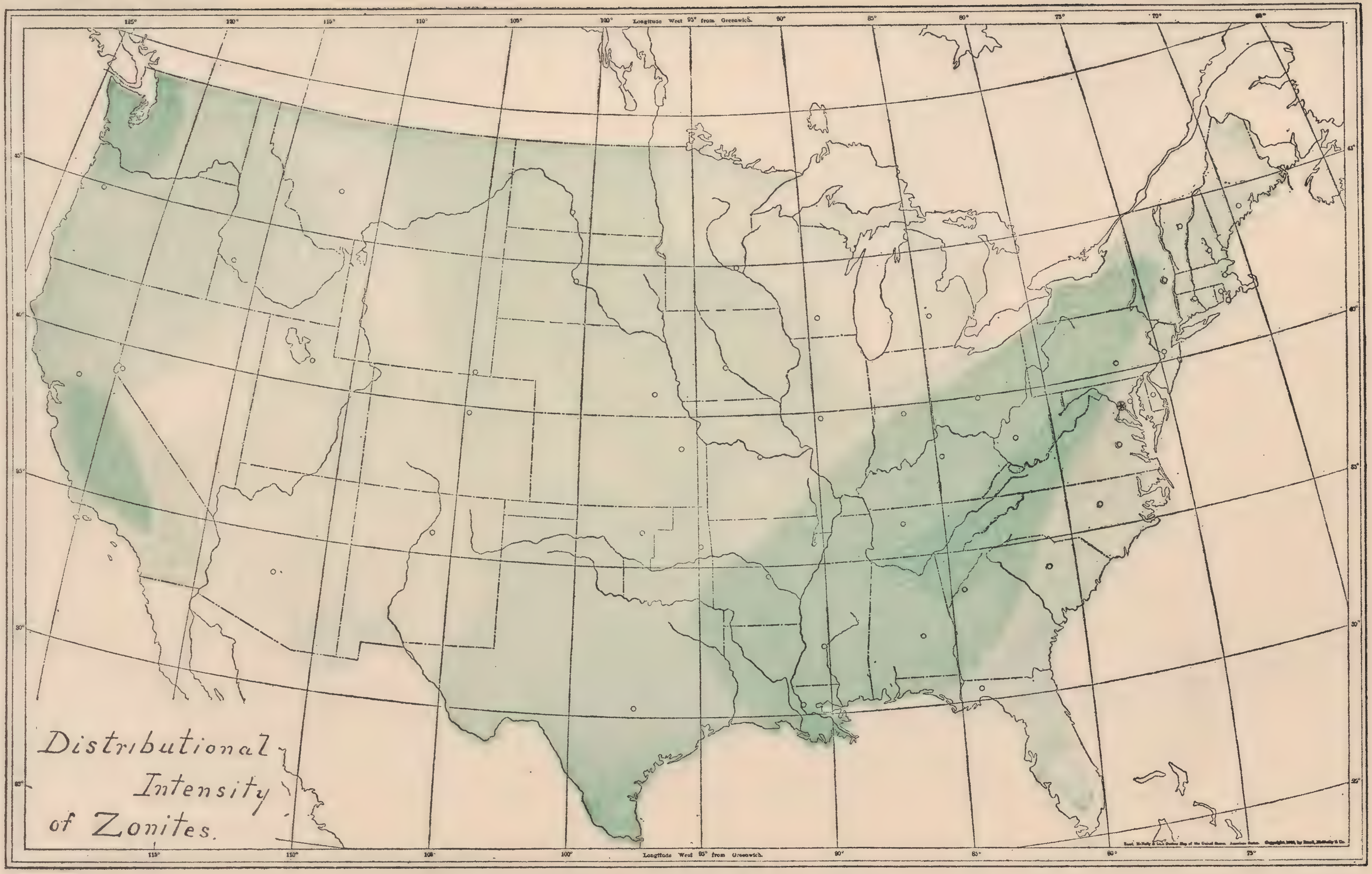
Cat. No. 2141. **Louisiana,** Alexandria, 1.

Succinea forsheyi *Lea.*

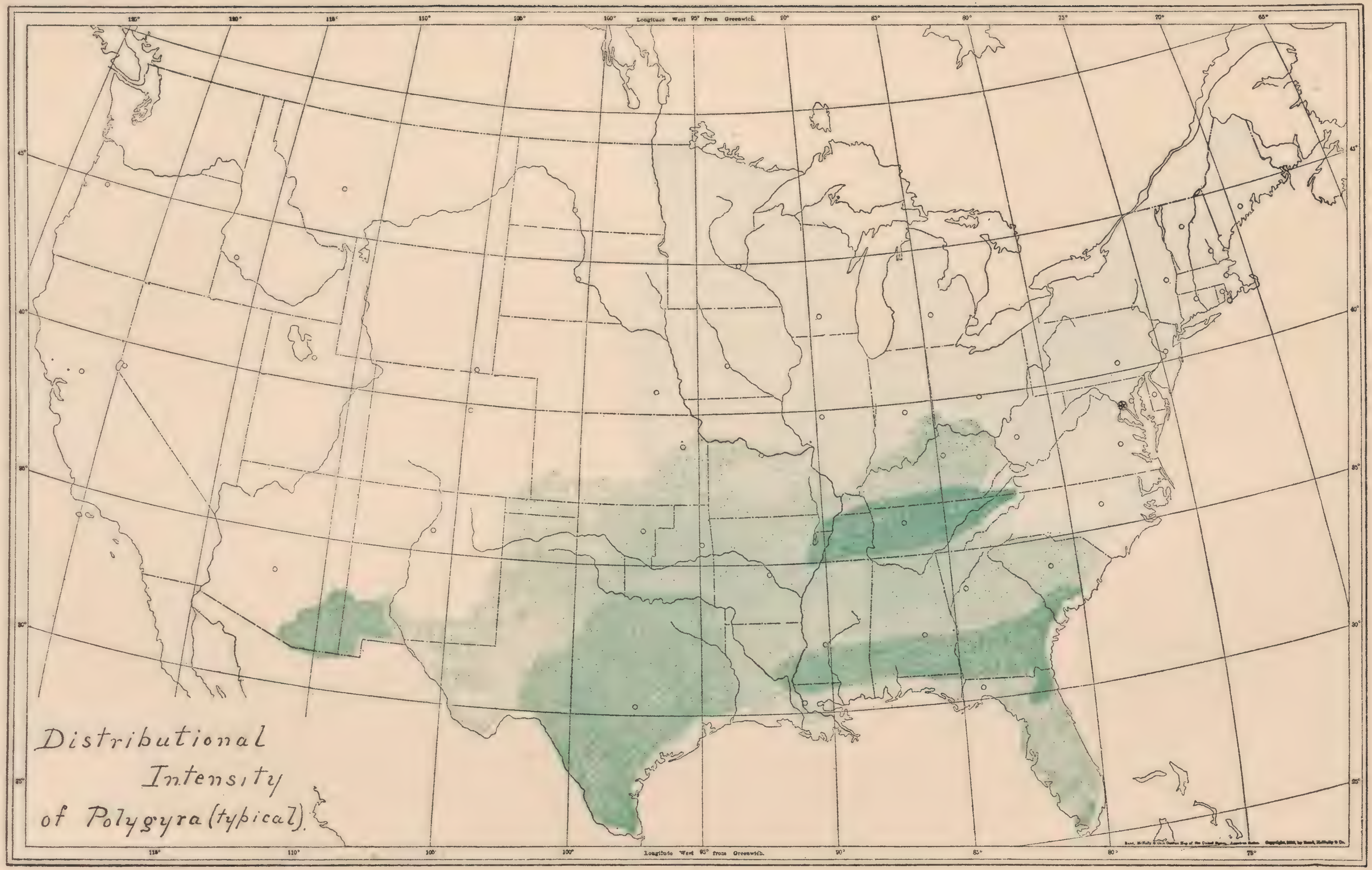
Cat. No. 2142. **Texas,** Rutersville, 1.

Succinea pellucida *Lea.*

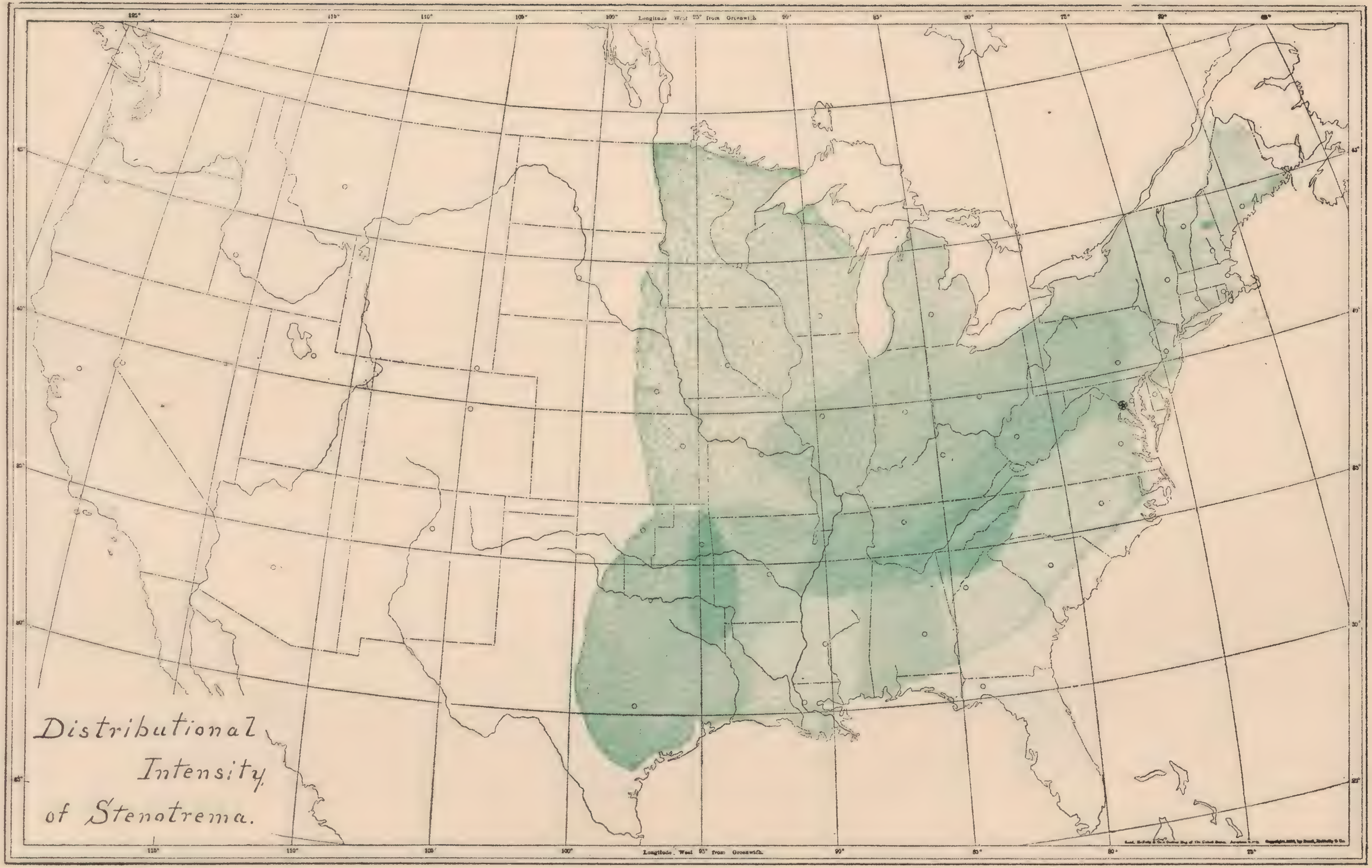
Cat. No. 2143. **United States,** 1. Miscellaneous lots from California and Idaho, 30.



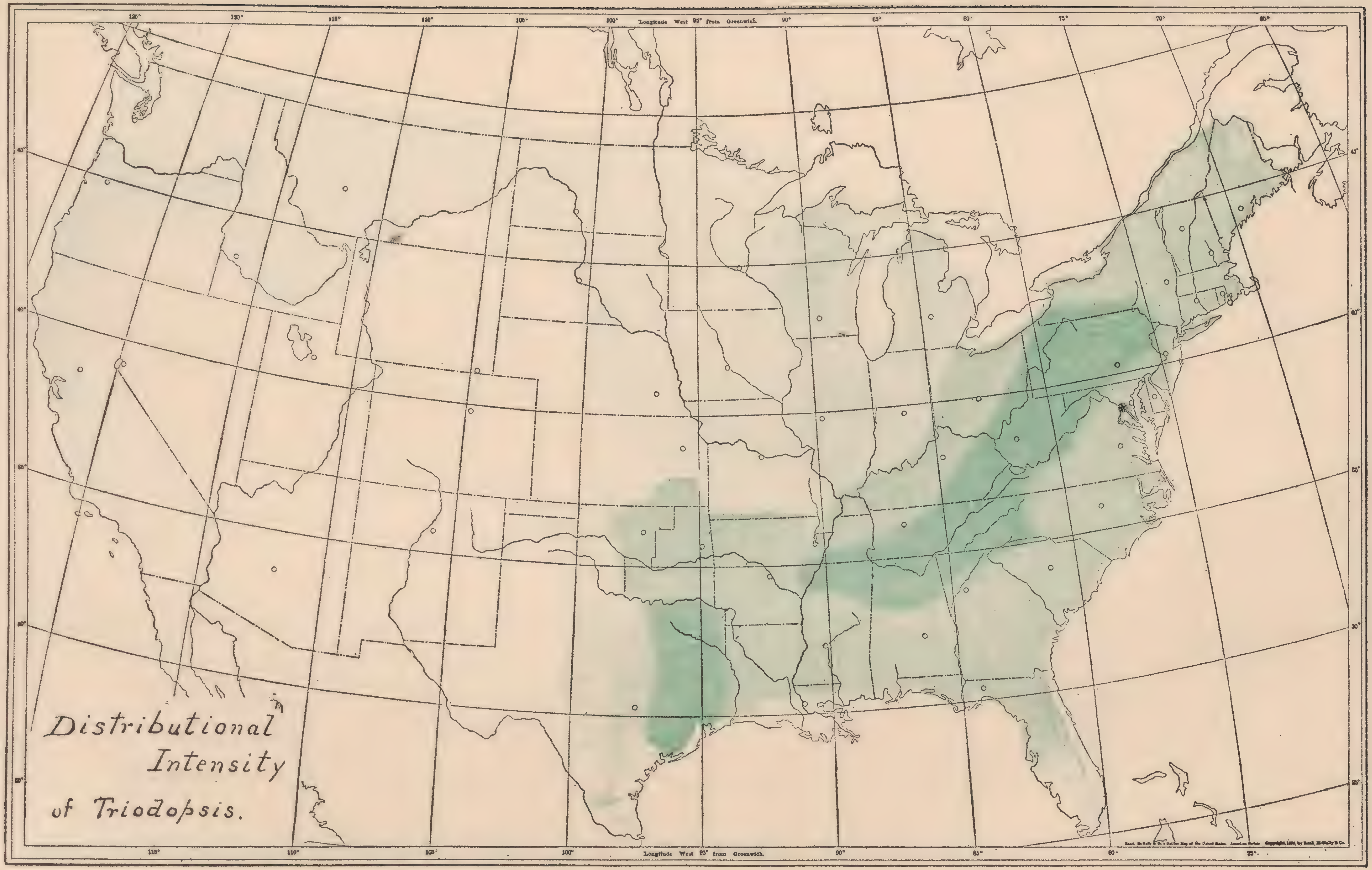
DISTRIBUTIONAL INTENSITY OF ZONITES.



DISTRIBUTIONAL INTENSITY OF POLYGYRA (TYPICAL).



DISTRIBUTIONAL INTENSITY OF STENOTREMA.


Distributional Intensity of Triodopsis.
125°
120°
115°
110°
105°
100°
Longitude West 95° from Greenwich.
90°
85°
80°
75°
70°
65°
45°
40°
35°
30°
25°
Rand, McNally & Co.'s Outline Map of the United States. American Series.
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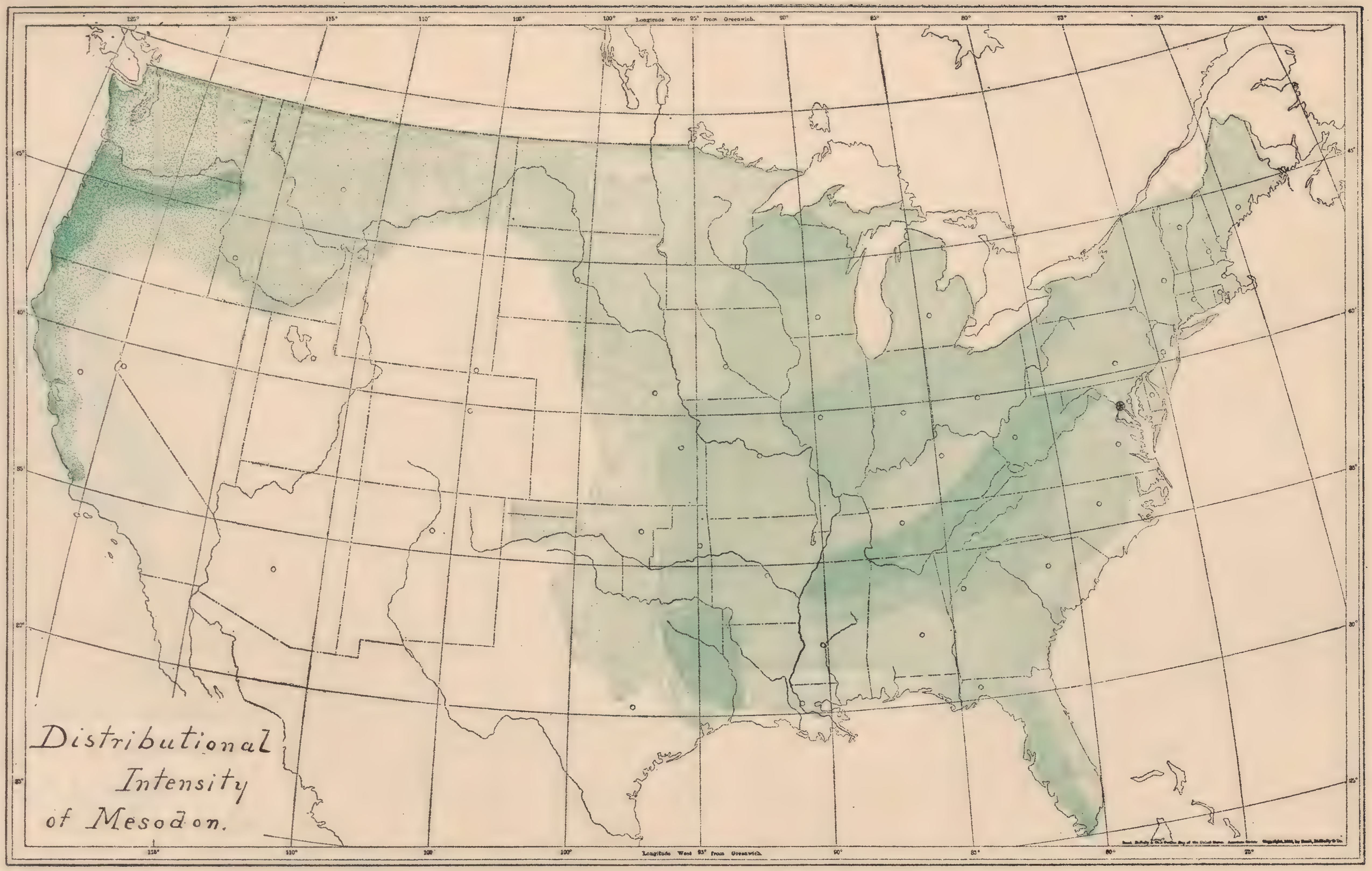
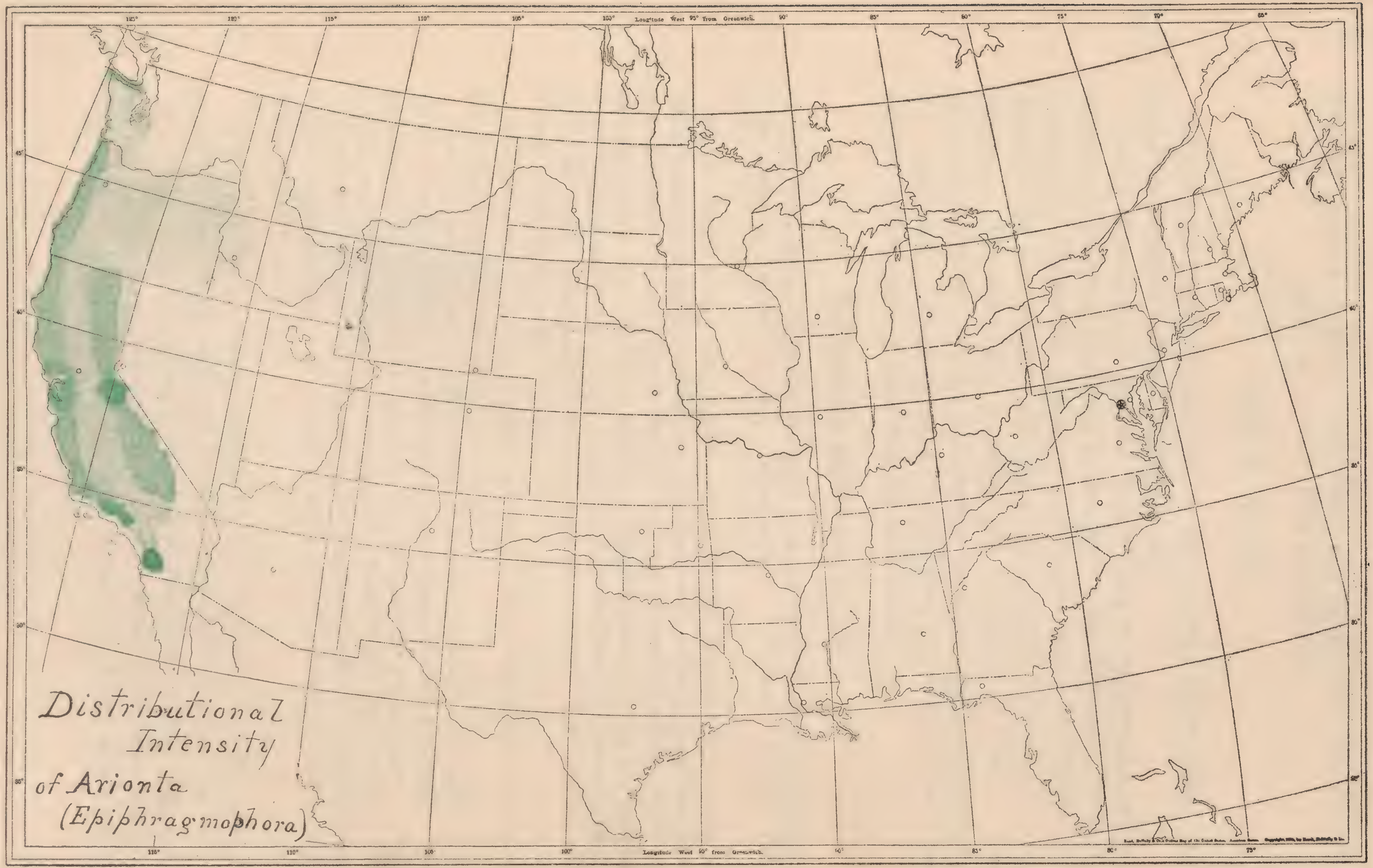
DISTRIBUTIONAL INTENSITY OF TRIODOPSIS.



DISTRIBUTIONAL INTENSITY OF MESODON.



DISTRIBUTIONAL INTENSITY OF ARIONTA (EPIPHRAGMOPHORA).

Article XXIV.—NEW SOUTH AMERICAN MURIDÆ AND A NEW METACHIRUS.

BY J. A. ALLEN.

Of the nine species described in the present paper eight are based on material in the British Museum.

In this connection I take the opportunity to express my appreciation of the great kindness shown me by Mr. Oldfield Thomas, Curator of Mammals, during a few weeks spent at the British Museum the past summer, chiefly in the study of South American Rodents. He not only allowed me unrestricted use of the material under his charge, but greatly aided me in many ways in my researches. The following descriptions of new species were written in response to his generous solicitation.

Oryzomys bolivaris, sp. nov.

Type, No. 99–9–9–27, British Museum, ♂ adult, Porvenir, Bolivar, Ecuador, altitude 1800 m., March 10, 1899; collected by P. O. Simons. Original No. 251.

Above medially very dark brown, punctated with ferruginous, the general effect being what might be called dark chestnut brown; sides lighter, more yellowish brown, becoming gradually paler towards the ventral surface, which is sharply defined and dull white, the fur being plumbeous at base and broadly tipped with soiled white; upper surface of fore and hind feet nearly naked, dull flesh color, soles blackish brown; ears rather small, dark brown; tail naked, pale brown, nearly unicolor.

Measurements (of type and only specimen).—Total length, 225 mm.; head and body, 125; tail, 100; hind foot, 29; ear, 18.

The skull presents nothing distinctive; it is rather narrow for its length, with rather a broad postpalatal opening and rather large palatal foramina. The teeth are of medium size, but in the single specimen are greatly worn. Total length, 30.2; basilar length, ——; zygomatic width, 15.2; mastoid width, 12; postorbital width, 5.2; length of nasals, 12; length of palate, 6; palatal foramina, 6; upper toothrow, 4.5; length of lower jaw, 16; height of condyle, 8.5; lower toothrow, 4.8.

This species is characterized by the dark color of the dorsal surface, small ears, and tail considerably shorter than the head and body. In coloration it somewhat resembles the *S. magdalenæ* group, but the general effect is much darker and more bordering on dark chestnut than yellowish brown, but from which group it differs in its relatively somewhat shorter tail and very much smaller ears. Known at present only from the type specimen.

Oryzomys castaneus, sp. nov.

Type, No. 1–3–19–11, British Museum, ♀ adult, St. Javier, northern Ecuador, altitude 60 feet, July 28, 1900; collected by G. Flemming and R. Miketta. Orig. No. 171.

Similar in texture of pelage and coloration to *O. nitidus*, but much smaller, with relatively as well as absolutely much weaker dentition. General color above dark reddish brown or light chestnut, paler, more yellowish brown on the sides; below dull whitish or soiled grayish white, the fur being plumbeous at base and broadly tipped with whitish. Upper surface of fore and hind feet nearly naked, flesh color, palms flesh color, soles dark brown; ears of medium size, brown; tail much shorter than head and body, naked, pale brown above, slightly lighter below.

Measurements (of type and only specimen).—Total length, 223 mm.; head and body, 118; tail, 105; hind foot, 29; ear, 19. Skull of the typical form for the genus, with a well-developed supraorbital bead, running back to the parieto-occipital suture; interparietal large; posterior palatal opening broad for the size of the skull; palatal foramina small; molar dentition weak. Total length, 30; basilar length, ——; zygomatic width, 14.4; mastoid width, 11.3; postorbital width, 5.3; length of nasals, 11.2; interparietal, 3 × 9; length of palate, 7; palatal foramina, 4; upper toothrow, 4.1; lower jaw, length, 15; height at condyle, 7.8; lower toothrow, 4.6.

This species, at present known only from the type, bears a close resemblance in coloration to *O. nitidus* (*Hesperomys laticeps*, var. *nitidus* Thomas, type, 85–4–1–41, Br. Mus), from Amable Maria, Central Peru (P. Z. S., 1884, 452, pl. xlii, fig. 1), but is smaller, with a very much shorter and narrower hind foot (27 against 30.5 in *O. nitidus*, type, both from dry skins), relatively shorter tail, and much weaker molar dentition.

Oryzomys perenensis, sp. nov.

Type, No. 0–7–7–25, British Museum, ♂ adult, Perené, Department of Junin, Peru, April 11, 1900; altitude 800 m. Collected by P. O. Simons; collector's No. 930.

Very similar in coloration, texture of pelage, size, and proportions to *O. magdalenæ* Allen, but with the skull much broader and the dentition much heavier.

Measurements (of type).—Total length, 237 mm.; head and body, 125; tail, 112; hind foot, 31; ear, 22. Seven adults range in total length from 227 to 260 (one very old male reaches 279); length of head and body, from 118 to 135 (with one, 144); tail length, 105 to 125 (one, 135); hind foot, 28–33; ear, 20–25.

The skull and teeth present no differences of distinctive importance. Compared with *O. magdalenæ*, its nearest known ally, the skull is much broader throughout, with the teeth of the molar series about one third broader. Total length, 34; basilar length, 21.6; zygomatic width, ——; mastoid width, 13; postorbital width, 5; length of nasals, 13; palatal length, 8; palatal foramina, 5; length of upper toothrow, 5; length of lower jaw, 17; height at condyle, 8.6; lower toothrow, 5.8.

This species is based on a series of 11 specimens, collected by Mr. P. O. Simons at Perené, Department of Junin, Peru, at an altitude of 800 m., in March and April, 1900. The series includes several young adults, which are darker, especially along the median line above, with less of the yellowish brown of the adults. One old male (No. 0–7–7–25) is much larger than the rest of the series and of a rather deeper brown above. One young example (No. 0–7–7–26) is exceptional for the strong wash of pale yellowish brown on the sides.

Externally this form is not readily distinguished from *O. magdalenæ*, but the two are easily separable on comparison of the skulls. Both are apparently geographical forms of *O. laticeps*.

Oryzomys rivularis, sp. nov.

Type, No. 1–1–6–5, British Museum, ♀ adult, Rio Verde, northern Ecuador, altitude 3200 feet, Nov. 28, 1899; collected by R. Miketta.

In coloration throughout essentially like *O. bolivaris*, but much larger and with the tail much longer than head and body.

Measurements (of type and only specimen).—Total length, 238 mm.; head and body, 111; tail, 127; hind foot, 32; ear, 17.

Skull narrow and slender, as in *O. magdalenæ*, but the rostral portion still more elongated and narrower, the zygomatic branch of maxilla broader, the anterosuperior border more produced, and the enclosed foramen less expanded laterally; posterior palatal opening broader; dentition weak, as in *O. magdalenæ*. Total length, 32; basilar length, 23.6; zygomatic width, 15; mastoid width, 12; postorbital width, 6; length of nasals, 7; length of palate, 7; palatal foramina, 4; upper toothrow, 4.6; length of lower jaw, 17; height at condyle, 8; lower toothrow, 5 mm.

This form closely resembles *O. bolivaris* in coloration and in the small size of the ears, in comparison with these members in the *O. laticeps* group, and from which group it further differs in the length of the tail, considerably exceeding that of the head and body. Known at present only from the type, in which the body is much overstuffed, it greatly exceeding the measurements taken from the specimen in the flesh.

Phyllotis chacoënsis, sp. nov.

Type, No. 98-5-14-2, British Museum, ♀ adult, Waikthlatingwayalwa, Chaco boreal, Paraguay; Graham Kerr, Sept. 5, 1897.

Pelage thick and soft. Above strongly yellowish brown, varied with black-tipped hairs, chiefly on the back; sides with fewer black-tipped hairs, and more strongly yellowish, or ochraceous buff; nose and top of head more grayish; cheeks like the sides; below pure white to the base of the hairs; fore arm, thighs, and hind legs like adjoining parts of the body; upper surface of fore and hind feet white, well clothed; palms and soles naked, the former flesh color, the latter darker, or brownish flesh color; ears large, dull brown, thinly haired on both surfaces; a small yellowish white tuft at posterior base of ear; tail much longer than head and body, bicolor, dark brown or blackish above, white below, well haired, the hairs increasing in length toward the end of the tail, forming a brushy pencil at the tip.

Measurements.—Total length (of type), 327 mm.; head and body, 142; tail, 185; hind foot, 31 (without claws, 33 with claws); ear, 24. Another specimen gives the following measurements, taken from a well-made skin: Total length, 267; head and body, 120; tail, 147; hind foot, 29; ear, 18.

Skull long and narrow, with a narrow brain case, interparietal very broad, the anterosuperior border of the maxillary plate of the zygoma produced to form a slight angle, in this feature diverging from the *Phyllotis darwini* type toward *Euneomys;* bullæ large; molars (including $m\underline{2}$) nearly as in *Phyllotis darwini*, but bullæ much larger, molar series much broader, and brain case relatively much narrower. The type skull measures as follows: Total length, 38; basilar length, 29; length of nasals, 16; zygomatic breadth, 18; mastoid breadth, 14; interorbital breadth, 6; palatal length, 7.2; palatal foramina, 8 × 2.5; upper toothrow, 5; lower jaw (from inner base of incisors to condyle), 19; height at condyle, 10; lower toothrow, 5.3.

This species resembles most nearly *Phyllotis griseoflavus* (Waterh.), with the type of which it has been compared, but from which it differs in its brighter, more buffy coloration, and in the fur on the ventral surface being wholly white to the base, instead of basally pale plumbeous. It is also apparently larger. The type locality of *P. griseoflavus* is the mouth of the Rio Negro, Patagonia, to which species three other specimens from Chupat, Patagonia, are evidently referable. The type locality of *P. chacoënsis* is the northern Chaco country of Paraguay, northwest of Asuncion.

P. chacoënsis is based on three specimens from Waikthlatingwayalwa. They all agree very closely in external features, including the wholly white fur of the ventral surface.

Phyllotis cachinus, sp. nov.

Type, No. 97-5-5-19, British Museum, ♀ adult, Upper Cachi River, Salta, Argentina, collected and presented by Prof. Spegazzini.

Similar to *P. griseoflavus* in general coloration, but with the pelage of the ventral surface pale grayish at extreme base, instead of deep plumbeous for the basal half or more. It also differs from *P. griseoflavus* in the skull being broader, including both the brain case and the rostral portion, with very much heavier dentition, the molar series being one-third broader as well as longer, and with a much heavier lower jaw.

It differs from *P. chacoënsis* in its shorter parietal (11×3 as against 11×4 in *P. chacoënsis*), heavier dentition, more inflated bullæ, and smaller size.

Measurements (of type).—Total length, 296 mm.; head and body, 137; tail, 159; hind foot, 29; ear, 24.

Skull about as in *P. griseoflavus* and *P. chacoënsis*, except in its rather greater relative breadth as compared with the former, and its short interparietal as compared with the latter, and much heavier dentition in comparison with either. Total length, 35; basilar length, 27; zygomatic breadth, 17; mastoid breadth, 14.5; interorbital breadth, 5; length of nasals, 15.5; palate, 6.8; palatal foramina, 7.2×2.5; interparietal, 11×2.8; upper toothrow, 5.4; lower jaw (inner base of incisors to condyle), 19; height at condyle, 9; lower toothrow, 5.7.

A specimen from the Lower Cachi, No. 79-5-5-18, ♀, from the same collector, with an imperfect skull, seems better referable to *P. chacoënsis*, it having the ventral pelage snow-white to the roots, and weaker dentition.

Doubtless *griseoflavus*, *chacoënsis*, and *cachinus* will prove to be closely related forms of the same species, but they show features of difference worthy of note, and, moreover, inhabit quite different faunal districts. The first two are chaco forms, widely separated geographically, while the latter is from the mountain district northwest of Salta.

Eligmodontia morgani, sp. nov.

Type, collector's No. 127, ♀ adult, Arroya Else, Patagonia, April 17, 1895; coll. A. E. Colburn.

Pelage very full, long, and soft. Above dull ochraceous gray, finely lined with black, sides paler and more buffy, passing into a well-defined pale yellowish lateral line, extending from the sides of nose to the base of the tail; lower parts pure white, the fur plumbeous at base, the apical half white; ears medium, dusky brown externally, pale buffy gray internally; tail about as long as head and body, sharply bicolor, dark brown above, grayish white below, well haired and slightly penicillate; fore and hind feet above grayish white, well covered with short hairs; soles and palms flesh color, sparsely haired, the flesh-colored skin barely showing through the hairs.

Measurements.—Total length (of type), 165 mm.; head and body, 85; tail, 80; hind foot, 23; ear (from dry skin), 13.

Skull much as in *E. elegans* but rather smaller, and with the same character of dentition. Total length, 24; basilar length, 17.5; zygomatic breadth, 12; mastoid breadth, 11; interorbital breadth, 4; length of nasals, 10; palate, 5; palatal foramina, 5×2; interparietal, 11×2.5; upper toothrow, 4; lower jaw, 12; height at condyle, 5.3; lower toothrow, 4.

This species has externally the appearance of a small-eared *Phyllotis* with furred soles. Its nearest known ally appears to be *E. elegans*, from which it differs in having much smaller ears and a shorter tail, the foot and body being nearly as in *E. elegans*.

The type of *E. elegans* was collected by Darwin at Bahia Blanca and is much changed in color by exposure for a long time (formally) as a mounted specimen. Two other specimens in fair condition from Chupat, northern Patagonia, identified as *E. elegans* by Mr. Thomas, very closely resemble in color the series of *E. morgani* from Sta. Cruz, but differ from them strikingly in their much larger ears and much longer tails. There are no flesh measurements, but the vertebræ still remain in the tail and the skins are fairly made up. Head and body (in skin), 78; tail vertebræ, 97; ear from notch, 19. The other specimen has the same proportions but is a little smaller.

This species is based on a large series of specimens collected at or near Cape Fairweather, Patagonia, by Mr. A. E. Colburn, for the Princeton Patagonian Expedition, generously supported by Mr. J. Pierrepont Morgan, after whom the species is named.

Akodon tucumanensis, sp. nov.

Type, No. 0–7–9–13, British Museum, ♀ adult, Tucuman, Argentina, alt. 450 m., June 29, 1899; coll. L. Dionelli.

Pelage very soft and full. Above dull ruddy brown, darker and more reddish than in *A. xanthorhinus*, minutely grizzled with black-tipped hairs, darkest over the back, lighter on the sides; sides of nose rather lighter, but not very distinctly different from the front of the head, in this differing from the *A. xanthorhinus-canescens* group; below buffy gray varying to strong buff; ears small, dark brown, edged within with buffy brown hairs; feet dusky gray above, soles of hind feet dusky brown; tail indistinctly bicolor, very thickly haired; blackish brown above, sides and below lighter, pale buffy gray.

Measurements.—Total length (type), 140.5 mm.; head and body, 81; tail, 59.5; hind foot, 17.5; ear 15. Three adults (2 males and 1 female) give the following: Total length, 136.8 (130–140.5); head and body, 77.8 (70–82.5); tail, 59 (57.5–60); hind foot, 17.8 (17–19); ear, 12.6 (12.5–15).

The skull presents no differences except those of size from its near congeners. Total length (type), 24; basilar length, 18; zygomatic breadth, 12; greatest width of brain case, 11.2; interorbital breadth, 5.2; nasals, 8; palate, 3; palatal foramina, 5.5; upper toothrow, 4.

Akodon tucumanensis belongs to the small-sized, soft-furred, short-tailed, small-eared, short-nosed group of which *A. olivaceus*, *A. xanthorhinus*, and *A. canescens* are typical representatives and its nearest allies, from which, however, it is strongly distinct in features of coloration. It is smaller than *olivaceus*, agreeing very nearly in size with *A. canescens* and *A. xanthorhinus*. It is thus far represented by only the three specimens above mentioned, all taken at Tucuman, June 29, July 1, and July 24, 1899, by Mr. L. Dionelli.

Metachirus nudicaudatus bolivianus, subsp. nov.

Type, No. 1–6–7–73, British Museum, ♀ ad., Chulumani, Yungas, Bolivia, alt. 2000 m., Feb. 14, 1901; P. O. Simons.

Above pale yellowish gray, strongly varied with black, the black most developed along the median line, giving the effect of a blackish dorsal area, which, in some specimens, takes the form of a quite distinct black median line; sides paler, more fulvous and less blackish; below pale buff, this color extending well up on the sides and on the outer edge of thigh and hind leg. Head black, slightly varied with gray along the frontal region and top of the nose; a broad black stripe extends from the whiskers to the base of the ear, enclosing the eye, and crossing over the head in front of the ears to join the blackish median band on the head; eye-spots ochraceous; feet dull yellowish gray brown, palms brownish flesh color, soles dusky; ears pale brown; tail brown for about the basal two-thirds, the apical portion whitish.

Measurements.—Type: Total length, 498 mm.; head and body, 225; tail, 273; hind foot, 40; ear, 38. A series of 6 specimens, 3 males and 3 females, measure as follows:

B. M. No.	Sex.	Head and body.	Tail.	Hind foot.	Ear.
1–6–7–71	♂	240	298	43	38
1–6–7–69	♂	243	308	42	38.5
1–6–7–70	♂ juv.	195	253	39	36
1–6–7–73	♀	225	273	40	38
1–6–7–74	♀	240	290	41	39
1–6–7–72	♀	238	300	42	38

Skull.—Type (young adult ♀): Total length, 54; basal length, 51; length of nasals, 27.5; width of nasals, 9 × 3.7; zygomatic breadth, 28; mastoid breadth, 16.5; interorbital breadth, 9.5; palatal length (from inner base of incisors), 30; breadth at $m^{\underline{4}}$, outside, 18; inside, 11; upper toothrow, 19.5; m^{1-4}, 11.

No. 1–6–7–72, ad. ♀ with worn teeth: Total length, 55; basal length, 52; length of nasals, 29; width of nasals, 9 × 4; zygomatic breadth, 28; mastoid breadth, 17; interorbital breadth, 9.5; palatal length, 31; upper toothrow, 20; m^{1-4}, 11.5.

Young. — Young examples, one-tenth to one-fourth grown, similar to adults in general coloration, but in the very young with a strongly marked black dorsal stripe, the cheeks and eye-spots brighter, approaching ochraceous buff.

Metachirus bolivianus belongs to the *M. nudicaudatus* group, but differs from all previously described members of it in the blackish variegation of the back, black-tipped hairs being not only a conspicuous feature of the dorsal coloration, but give in some specimens the prevailing tone, especially to the median area, which shows often a tendency to a distinct black median band, which in the young appears as a distinct, sharply defined line, wholly absent in young of corresponding age in *M. nudicaudatus* (Guiana specimens) and in *M. nudicaudatus colombica* (from near Bogota). It also differs from the other forms in the paler coloration of the sides and abdomen, outside of thighs, and eye-spots, with consequently greater contrast between the coloration of the dorsal and ventral surfaces. The black of the dorsal surface is about as in the *M. opossum* group, but with a pale yellowish gray color instead of a clear gray. Apparently its nearest ally is *M. nudicaudatus phæurus* Thomas from northern Ecuador (type and only specimen, 1–3–19–44, ♂ ad., May 19, 1900, St. Javier, N. Ecuador, alt. 60 feet; G. Flemming). The type of the latter is in short velvety pelage with a broad, ill-defined dusky median area and a wholly dark tail. This form corresponds to the dark form—*tschudii*—of the *M. opossum* group from Peru.

This subspecies is based on a series of 11 specimens, collected by P. O. Simons at Chulumani, Bolivia, of which 5 are young of various ages (2 nurslings, 2 apparently just old enough to shift for themselves, and 1 about two-thirds grown) and 6 fully adult. The series is very uniform in coloration, though varying a little in the amount of black on the back, except that the two very young specimens have the black median stripe more distinct than the older examples.

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ERRATA.

Page 46, line 1 at top, for **lutesens** read **lutescens.**
Page 217, line 17 from bottom, for **grisescens** read **griscescens.**
Page 225, line 5 from top, for **Synallaxsis** read **Synallaxis.**
Plates XXIX and XXX, in title at bottom, for n. sp. read Whitf.

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